

(19)



Europäisches Patentamt

European Patent Office

Office européen des brevets



(11)

EP 0 726 751 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:
29.03.2000 Bulletin 2000/13

(21) Application number: **94929169.4**

(22) Date of filing: **12.09.1994**

(51) Int. Cl.⁷: **A61F 13/15, A61F 13/56**

(86) International application number:
PCT/US94/10200

(87) International publication number:
WO 95/07675 (23.03.1995 Gazette 1995/13)

**(54) ABSORBENT ARTICLES HAVING PANTY COVERING COMPONENTS COMPRISING
EXTENSIBLE WEB MATERIALS WHICH EXHIBIT ELASTIC-LIKE BEHAVIOR**

ABSORBIERENDE ARTIKEL MIT SCHUTZELEMENTEN DIE DEHNBARE MATERIALIEN MIT
ELASTISCHEM VERHALTEN AUFWEISEN

ACCESSOIRES ABSORBANTS MUNI D'ELEMENTS COUVRANT LE SLIP ET COMPORTANT DES
MATIERES TISSEES EXTENSIBLES ET AYANT UN COMPORTEMENT PROCHE DE
L'ELASTICITE

(84) Designated Contracting States:
AT BE CH DE ES FR GB GR IT LI LU NL SE

(30) Priority: **17.09.1993 US 124180**

(43) Date of publication of application:
21.08.1996 Bulletin 1996/34

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EP-A- 0 335 527 **EP-A- 0 337 438**
WO-A-92/07528 **WO-A-93/06805**
US-A- 5 098 755 **US-A- 5 330 133**

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Description**FIELD OF THE INVENTION**

5 **[0001]** The present invention relates to absorbent articles such as sanitary napkins, panty liners, and incontinence pads. More particularly, the present invention relates to sanitary napkins that have longitudinal side edge components comprising web materials with a strainable network which exhibit elastic-like behavior without added elastic materials. The longitudinal side edge components naturally wrap the sides of a wearer's panties to provide an alternative to conventional side flaps.

BACKGROUND OF THE INVENTION

15 **[0002]** Absorbent articles such as sanitary napkins, pantliners, and incontinence pads are devices that are typically worn in the crotch region of an undergarment. These devices are designed to absorb and retain liquid and other discharges from the human body and to prevent body and clothing soiling. Sanitary napkins are a type of absorbent article worn by women in a pair of panties that is normally positioned between the wearer's legs, adjacent to the perineal area of the body. Sanitary napkins both with and without side flaps (or wings) are disclosed in the literature and are available in the marketplace. Some particularly preferred sanitary napkins that do not require flaps are described in U.S. Patents 4,950,264 and 5,009,653 issued to Osborn on August 21, 1990 and April 23, 1991, respectively.

20 **[0003]** Generally when sanitary napkins are provided with flaps, the flaps extend laterally from a central absorbent means and are intended to be folded around the edges of the wearer's panties in the crotch region. Thus, the flaps are disposed between the edges of the wearer's panties in the crotch region and the wearer's thighs. Commonly, the flaps are provided with an attachment means for either affixing the flaps to the underside of the wearer's panties or to the opposing flap. The flaps are particularly effective for preventing exudates from soiling the edges of the wearer's panties.

25 **[0004]** Sanitary napkins having flaps of various types are disclosed in U.S. Patent 4,687,478, entitled "Shaped Sanitary Napkin With Flaps", which issued to Van Tilburg on August 18, 1987; U.S. Patent 4,608,047, entitled "Sanitary Napkin Attachment Means", which issued to Mattingly on August 26, 1986; U.S. Patent 4,589,876, entitled "Sanitary Napkin", which issued to Van Tilburg on May 20, 1986 and its Reexamination Patent No. B1 4,589,876, Certificate of Reexamination issued April 27, 1993; U.S. Patent 4,285,343, entitled "Sanitary Napkin", which issued to McNair on August 25, 1981; U.S. Patent 3,397,697, entitled "Disposable Sanitary Shield For Undergarments", which issued to Rickard on August 20, 1968; and, U.S. Patent 2,781,271, entitled "Sanitary Napkin", which issued to Clark on April 2, 1957.

35 **[0005]** While sanitary napkins having flaps are commonly viewed as providing better protection against soiling as compared to sanitary napkins without flaps, some women find applying sanitary napkins having flaps to be inconvenient for various reasons. For instance, some women find it to be difficult to attach the flaps to the underside of the crotch of their panties. This can be due to factors such as the tendency for the adhesive fasteners on the flaps to stick to themselves or to other parts of the sanitary napkin. As a result, some women still prefer a sanitary napkin without flaps, and some women who generally prefer a sanitary napkin with flaps, occasionally (such as during periods of light flow) prefer a sanitary napkin without flaps. Therefore, there is a need for a sanitary napkin which provides an alternative to sanitary napkins having conventional side flaps while still providing the protection of side flaps.

40 **[0006]** In addition, both sanitary napkins with and without flaps are subject to the problem that the wearer's undergarments move with the wearer's movements during wear. Most sanitary napkins, however, provide no mechanism for adjusting to these movements. This puts stresses on the sanitary napkin and the flaps. These stresses may cause the sanitary napkin to shift from its desired position in the wearer's undergarment. The failure to provide the sanitary napkin with a mechanism to adjust to the difference between the movement of the wearer's undergarments and the wearer's body may also cause the sanitary napkin to be less comfortable than if it stretched and conformed with the wearer's movements and to the wearer's undergarments.

45 **[0007]** Several variations of sanitary napkins having conventional flaps that attempt to solve some, but not all of these problems are disclosed in the patent literature. For example, U.S. Patent 4,911,701 issued to Mavinkurve discloses a sanitary napkin having elastic strands for providing a greater convex shape to the body-facing portion of the central absorbent and for enabling adhesive-free placement of the flaps of a winged napkin embodiment into a pair of panties. The sanitary napkin described in the Mavinkurve patent, however, still appears to require the user to manipulate the flaps (by first flipping the flaps upward and then placing the flaps in her panties and flipping the flaps back down) since the flaps appear to be pre-disposed to be in a downward folded condition. The Mavinkurve patent also requires that individual elastic strands be attached in a contracted condition to the central absorbent portion of the napkin and/or to its wings or flaps. The napkins described in the Mavinkurve patent can, therefore, be difficult and expensive to manufacture. The Mavinkurve patent also does not disclose any mechanism to account for differences in movement and extensibility of the central absorbent of the napkin and the wearer's panties.

[0008] WO 93/06805 discloses an absorbent article, such as a sanitary napkin, having flaps and comprising zones of differential extensibility. U.S. Patent 4,940,462 issued to Salerno discloses a sanitary napkin with longitudinally expandable flaps. The flaps are designed to fold over the exterior of the wearer's panty and then to expand to conform with the contour of the panties. The Salerno patent, however (in Column 5), appears to require conventional adhesive fasteners to retain the flaps in place on the underside of the wearer's panties. Further, the sanitary napkin shown in the Salerno patent suffers from several drawbacks due to the fact that the longitudinally expandable flaps extend directly outward from the longitudinal sides of the absorbent element. The expandable flaps in Salerno are attached directly to an inextensible body. This limits the extensibility of the portions of the Salerno flaps that are located adjacent to the absorbent element. In order for the Salerno flaps to extend an amount sufficient to wrap around the panty elastics, the flaps have to have a relatively wide transverse dimension. This is shown in Figs. 3 and 4 of the Salerno reference. The extra flap material can extend too far outward beyond the panty elastics to create a sloppy border that hangs out of the wearer's panties.

[0009] Another drawback to the flap construction shown in both the Mavinkurve and Salerno references is that the attachment of the expandable flaps directly to the longitudinal sides of the absorbent element leads to the problem that any compression of the absorbent element will cause the flaps to retract transversely inward. Any bunching of the absorbent element in the sanitary napkins shown in these references, such as that caused by compression by the wearer's legs, causes the flaps to lose their ability to cover a given area of the wearer's panties. The Salerno patent, like the Mavinkurve patent, also does not disclose any mechanism to account for differences in movement and extensibility of the central portion of the napkin and the wearer's panties.

[0010] Thus, a need exists for an absorbent article, such as a sanitary napkin, that is provided with an alternative to conventional flaps. In particular, a need exists for a sanitary napkin having an alternative to conventional flaps which provides the protection from soiling of conventional flaps and which can conveniently and efficiently solve the problems caused when attempting to attach conventional flaps to the underside of the wearer's panties and of the failure of the sanitary napkins having conventional flaps to stretch to conform to the wearer's body and the wearer's panties. A need also exists for a sanitary napkin that has a mechanism to adjust to the difference between the movement of the wearer's panties and the wearer's body.

[0011] It is, therefore, an object of the present invention to provide an absorbent article, such as a sanitary napkin, that is able to provide coverage to the wearer's panties to reduce side soiling (i.e., staining of the edges of the panty crotch) without the use of conventional flaps.

[0012] It is another object of the present invention to provide an absorbent article, such as a sanitary napkin that automatically wraps around the sides of the wearer's panties by the simple action of the wearer pulling up her panties.

[0013] It is still another object of the present invention to provide an absorbent article, such as a sanitary napkin, that is able to wrap around the sides of the wearer's panties and stay without providing flaps having panty fasteners thereon, and without attaching separate elastic strands to the sanitary napkin.

[0014] It is another object of the present invention to provide an absorbent article, such as a sanitary napkin that has a mechanism for attachment of the sanitary napkin to the wearer's panties that stretches to conform to the wearer's body and the wearer's panties, and responds to the wearer's movements to allow better conformation between the sanitary napkin and the wearer's body and between the sanitary napkin and the wearer's panties.

[0015] It is yet another object of this invention to provide an absorbent article, particularly a relatively thin absorbent article, such as a sanitary napkin, that is capable of extending, or more preferably, stretching when the article is worn for improved comfort and fit.

[0016] These and other objects of the present invention will be more readily apparent when considered in reference to the following description and when taken in conjunction with the accompanying drawings.

45 SUMMARY OF THE INVENTION

[0017] The present invention provides an absorbent article, such as a sanitary napkin. The sanitary napkin of the present invention has an undergarment covering component (or "panty covering component") that provides coverage to the wearer's panties to reduce side soiling (i.e., staining of the edges of the panty crotch) without the use of conventional flaps.

[0018] The sanitary napkin comprises a main body portion comprising a liquid pervious topsheet; a liquid impervious backsheet joined to the topsheet; and an absorbent core positioned between the topsheet and the backsheet. The undergarment covering component (or panty covering component) is joined to the main body portion. The undergarment covering component is wider than the crotch region of the undergarment. The undergarment covering component has a pair of short, flexible (and in some embodiments, drapable) longitudinal side portions (or "side wrapping elements") that extend beyond the crotch edge portions of the wearer's undergarment. The undergarment covering component comprises at least some extensible portions that are provided with a low return force or no return force (force that tends to cause the extensible portions to retract after they have been extended). Preferably, the extensible portions

comprise at least a portion of the undergarment covering component which is located between the affixation points where the undergarment covering component is joined to the main body portion and the distal edges of the side wrapping elements. The side wrapping elements have a high fold retention. The fact that the extensible portions are provided with a low return force and the side wrapping elements have a high fold retention allows the side wrapping elements of the undergarment covering component to automatically fold around the crotch edge portions of the wearer's undergarment toward the underside of the undergarment and to remain so folded when the absorbent article is placed in an undergarment and the undergarment is pulled up adjacent the wearer's body.

[0019] The extensible portions of the undergarment covering component comprise web materials with a strainable network which exhibit elastic-like behavior without added elastic materials. These portions can be extensible in the longitudinal direction, the transverse direction, or both.

[0020] A non-limiting number of variations of the undergarment covering component are described herein. For instance, the undergarment covering component can comprise the backsheet of the sanitary napkin. In still other embodiments, the sanitary napkin can include an undergarment covering component which is a separate element that is attached to the main body portion of the sanitary napkin at spaced apart attachment zones. The undergarment covering component is unattached to the main body portion between the attachment zones to provide unattached portions of the undergarment covering component in the central region of the main body portion. The unattached portions of the undergarment covering component are capable of separating from the main body portion so that the main body portion of the sanitary napkin can stay in contact with the wearer's body and the undergarment covering component can stay attached to the wearer's panties even when the panties pull away from the wearer's body during wear.

[0021] In variations of this latter embodiment, the undergarment covering component can be joined to the main body portion of the sanitary napkin by material that has slack built into it by providing flaccid material, pleated material, extensible material, or the like between the main body portion and the undergarment covering component. Numerous other variations are possible. For example, the sanitary napkin of the present invention may comprise a main body portion that has its longitudinal side margins folded inward underneath the main body portion of the sanitary napkin and the longitudinal side margins attached to an extensible panty covering component that extends outward beyond the longitudinal side margins of the main body portion. In still another embodiment, the sanitary napkin comprises an extensible main body portion (including an extensible topsheet that is attached to an extensible backsheet which extends beyond the longitudinal edges of the absorbent core).

[0022] The sanitary napkin of the present invention provides an alternative to sanitary napkins having conventional side flaps for several reasons. The undergarment covering component does not extend far enough outward beyond the side edges of the wearer's panties to cause any inconvenience to the wearer. The undergarment covering component requires no action on the part of the wearer to fold the side wrapping elements under her panties or to attach the same to her panties. The undergarment covering component stays in place well enough to cover the sides edges of the wearer's panties without affixing it underneath the wearer's panties. Providing the sanitary napkin with an undergarment covering component comprised of web materials with a strainable network which exhibit elastic-like behavior without added elastic materials allows the sanitary napkin having the features described above to be manufactured at a much lower cost than using elastomeric films and elastomeric adhesive films to give the panty covering component its extensibility.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] While the specification concludes with claims particularly pointing out and distinctly claiming the subject matter which is regarded as forming the present invention, it is believed that the invention will be better understood from the following description which is taken in conjunction with the accompanying drawings in which:

FIG. 1 is a top plan view of a preferred embodiment of the sanitary napkin of the present invention.

FIG. 2 is a sectional view taken along line 2-2 of the sanitary napkin shown in FIG. 1.

FIG. 3 is a side view of the sanitary napkin shown in FIG. 1 shown before use.

FIG. 4 is a side view of the sanitary napkin shown in FIG. 1 (taken from an angle similar to that of FIG. 3) in an in-use configuration.

FIG. 5 is an end view of the sanitary napkin shown in FIG. 1 in an in-use configuration.

FIG. 6 is a top plan view showing the extensibility of the main body portion of the sanitary napkin shown in FIG. 1.

FIG. 7 is a table which shows preferred relationships between the magnitude of stretching forces applied to the sanitary napkin and the amount the sanitary napkin stretches in response to such forces.

FIG. 8 is a plan view of an absorbent core that is provided with slits in the end regions of the same.

FIGS. 9 and 9A are simplified schematic end views of a known sanitary napkin having longitudinally extensible flaps. Fig. 9A, and the other figures designated with a letter "A", are end views shown after the absorbent element has been compressed. (These figures have been shown without the flaps wrapped around the crotch of an undergarment for simplicity.)

FIGS. 10 through 15C are end views of several basic embodiments that show various features of the sanitary napkin of the present invention.

FIG. 16 is a simplified schematic side view of the procedure used to measure resistance to edge compression of the side wrapping elements.

FIGS. 17-20 are plan views of sanitary napkins having several alternative configurations of the attachment mechanism used to join the panty covering component to the main body portion of the sanitary napkin.

FIG. 21 is a bottom plan view of a panty covering component having hook-like mechanical fasteners distributed radially on portions thereof, as shown in place in a section of a panty crotch.

FIG. 22 is a perspective view of a portion of a panty with the sanitary napkin of the present invention in place therein.

FIG. 23 is a plan view of an alternative embodiment of the panty covering component of the present invention.

FIG. 24 is a top plan view of a sanitary napkin having a panty covering component that is generally inextensible with the exception of zones in the corners of the panty covering component.

FIG. 25 is a schematic cross-sectional view of a sanitary napkin having its longitudinal side margins folded underneath its main body portion and attached to a panty covering component.

FIG. 26 is a simplified schematic cross-sectional view of a sanitary napkin comprised of extensible components in which the backsheet is an extensible material that extends outward beyond the topsheet and absorbent core to serve as the panty covering component.

FIG. 27 is a graph showing several cycles of elongation of an extensible material from which the "set" of the material can be determined.

FIG. 28 is a graph that shows the edge compression of an extensible material.

FIG. 29 is a schematic cross-sectional view of a sanitary napkin having a panty covering component comprised of a laminate formed of two nonwoven webs and a web material comprising a strainable network which exhibits elastic-like behavior.

FIG. 30 is a plan view photograph of a preferred embodiment of a polymeric web material having a strainable network which is used in the panty covering component of the present invention (shown with the deformations facing toward the viewer).

FIG. 31 is a segmented, perspective illustration of the polymeric web material of FIG. 30 in an untensioned condition.

FIG. 32 is a segmented, perspective illustration of a polymeric web material of FIG. 30 in a tensioned condition corresponding to stage I on the force-elongation curve depicted in FIG. 34.

FIG. 33 is a segmented perspective illustration of the polymeric web material of FIG. 30 in a tensioned condition corresponding to stage II on the force-elongation curve depicted in FIG. 34.

FIG. 34 is a graph of the resistive force versus percent elongation comparing the strainable web material shown in FIG. 30 with an otherwise identical, planar, base polymeric web material.

FIG. 35 is a schematic cross-sectional view of another embodiment of a sanitary napkin in which a single nonwoven web is wrapped around a web material having a strainable network to form the side wrapping elements of the sanitary napkin.

FIG. 36 is a schematic cross-sectional view of a sanitary napkin provided with the panty covering component shown in FIG. 37.

FIG. 37 is a plan view of a panty covering component comprising a laminate such as that shown in FIG. 29 which is additionally provided with edge stiffening members.

FIG. 38 is a plan view of a sanitary napkin having a panty covering component provided with edge stiffening members of an alternative configuration.

DETAILED DESCRIPTION OF THE INVENTION

1. General Characteristics of the Absorbent Article

[0024] The overall characteristics of the absorbent article of the present invention will be discussed first.

[0025] FIGS. 1-5 show a preferred embodiment of a disposable absorbent article of the present invention 20. The present invention relates to absorbent articles, such as sanitary napkins. More particularly, the present invention relates to sanitary napkins that have a main body portion 21 (or "basic sanitary napkin" or "base sanitary napkin") that comprises the portions of the sanitary napkin without the undergarment covering component, and an undergarment covering component ("garment covering component", or "panty covering component") 100 that preferably stretches with the wearer's panties and automatically wraps the sides of the wearer's panties when the wearer places the sanitary napkin in her panties and pulls her panties up.

[0026] The term "absorbent article", as used herein, refers to articles which absorb and contain body exudates. More specifically, the term refers to articles which are placed against or in proximity to the body of the wearer to absorb and contain the various exudates discharged from the body. The term "absorbent article" is intended to include sanitary napkins, pantliners, and incontinence pads (and other articles worn in the crotch region of a garment). The term "disposable" refers to articles which are intended to be discarded after a single use and preferably recycled, composted, or otherwise disposed of in an environmentally compatible manner. (That is, they are not intended to be laundered or otherwise restored or reused as an absorbent article.) In the preferred embodiment illustrated, the absorbent article is a sanitary napkin designated 20.

[0027] The term "sanitary napkin", as used herein, refers to an article which is worn by females adjacent to the pudendal region that is intended to absorb and contain the various exudates which are discharged from the body (e.g., blood, menses, and urine). It should be understood, however, that the present invention is also applicable to other feminine hygiene or catamenial pads such as panty liners, or other absorbent articles such as incontinence pads, and the like.

[0028] The sanitary napkin 20 has two surfaces, a liquid pervious body-contacting surface or "body surface" 20A and a liquid impervious garment surface 20B. The sanitary napkin 20 is shown in FIG. 1 as viewed from its body surface 20A. The body surface 20A is intended to be worn adjacent to the body of the wearer. The garment surface 20B of the sanitary napkin 20 (shown in FIG. 2) is on the opposite side and is intended to be placed adjacent to the wearer's undergarments when the sanitary napkin 20 is worn.

[0029] The sanitary napkin 20 has two centerlines, a longitudinal centerline L and a transverse centerline T. The term "longitudinal", as used herein, refers to a line, axis or direction in the plane of the sanitary napkin 20 that is generally aligned with (e.g., approximately parallel to) a vertical plane which bisects a standing wearer into left and right body halves when the sanitary napkin 20 is worn. The terms "transverse" or "lateral" used herein, are interchangeable, and refer to a line, axis or direction which lies within the plane of the sanitary napkin 20 that is generally perpendicular to the longitudinal direction.

[0030] FIG. 1 shows that the main body portion 21 of the sanitary napkin 20 has two spaced apart longitudinal edges 22, two spaced apart transverse or end edges (or "ends") 24, and four corners 27, which together form the periphery 26 of the main body portion of the sanitary napkin 20. The main body portion also has two end regions, which are designated first end region 28 and second end region 30. A central region 32 is disposed between the end regions 28 and 30. The end regions 28 and 30 extend outwardly from the edges of the central region 32 about 1/8 to about 1/3 of the length of the main body portion. A detailed description of the central region 32 and the two end regions 28 and 30 is contained in U.S. Patent 4,690,680 issued to Higgins on September 1, 1987.

[0031] The sanitary napkin 20 (or main body portion thereof) can be of any thickness, including relatively thick, relatively thin, or even very thin. The embodiment of the sanitary napkin 20 shown in Figures 1-3 of the drawings is intended to be an example of a relatively thin sanitary napkin, preferably an "ultra-thin" sanitary napkin. It should be understood, however, when viewing these figures the number of layers of material shown cause the sanitary napkin 20 to appear much thicker than it actually is. An "ultra-thin" sanitary napkin 20 as described in U.S. Patents 4,950,264 and 5,009,653 issued to Osborn preferably has a caliper of less than about 3 millimeters. The thin sanitary napkin 20 shown should also be preferably relatively flexible, so that it is comfortable for the wearer.

[0032] FIG. 2 shows the individual components of the main body portion 21 of the sanitary napkin 20 of the present invention. The main body portion 21 shown in FIG. 2 generally comprises at least three primary components. These include a liquid pervious topsheet 38, a liquid impervious backsheet (or "barrier means") 40, and an absorbent core 42 positioned between the topsheet 38 and the backsheet 40. There are occasions, however, when one or more of these components, such as the backsheet, can be replaced by a component that serves as part of the undergarment covering component described below. The main body portion 21 of the sanitary napkin 20 can be comprised of mostly conventional components, and as a result, be generally inextensible. In preferred embodiments, however, main body portion of the sanitary napkin is one of those described in PCT Publication Nos. WO 93/01785 and 93/01786 both published February 4, 1993, in the name of Osborn, et al. which is comprised of one or more extensible components. More preferably, the main body portion 21 is comprised of all extensible components, and the sanitary napkin has an overall extensibility.

[0033] The sanitary napkin 20 of the present invention also comprises a panty covering component 100. The panty covering component 100 comprises a pair of side wrapping elements 52 that extend laterally outward beyond the longitudinal side edges 22 of the main body portion 21 a distance of less than one-half the width of the main body portion to the distal edges 53 of the side wrapping elements 52. At least portions of the panty covering component 100 are extensible. The extensible portions of the panty covering component 100 should generally be located between the points where the panty covering component is attached to the main body portion, Q, and the distal edges 53 of the side wrapping elements 52. The side wrapping elements 52 are the portions of the panty covering component 100 that will automatically fold around the crotch edge portions of the wearer's panties toward the underside of the panties when the sanitary napkin is placed in the wearer's panties and the panties are pulled up adjacent the wearer's body.

[0034] The extensibility of the main body portion 21 of the sanitary napkin 20 is shown in a simplified fashion in Fig. 6. The term "extensible", as used herein, refers to articles that can increase in at least one of their dimensions in the x-y plane. The x-y plane is a plane generally parallel to the faces of the sanitary napkin 20. The main body portion 21 of the sanitary napkin 20 shown in Figure 6 is preferably extensible both in length and width. The main body portion 21 of the sanitary napkin 20, in other embodiments however, may only be extensible in one of these directions. Preferably, the main body portion of the sanitary napkin 20 is extensible at least in the longitudinal direction.

[0035] The main body portion 21 of the sanitary napkin 20 may in some preferred embodiments, in addition to being extensible, also be stretchable. The term "stretchable", as used herein, refers to articles that are extensible when stretching forces are applied to the article and offer some resistance to stretching. More preferably still, the main body portion 21 of the sanitary napkin 20 may be elastically stretchable. The terms "elastically stretchable" or "elastically extensible" are intended to be synonymous. These terms, as used herein, mean that when the stretching forces are removed, the main body portion will tend to return toward its unextended or unstretched (or original) dimensions. The main body portion 21 need not return all the way to its unstretched dimensions, however. It may, as shown in Figure 6, return to relaxed dimensions (such as L_R and W_R) between its unstretched dimensions and extended (or stretched dimensions) L_S and W_S . Making the main body portion 21 elastically stretchable will reduce the undesirable tendency of the main body portion to gather longitudinally inward (i.e., bunch longitudinally) when forces which tend to stretch the sanitary napkin are removed. This is particularly true when the wearer's panties contract.

[0036] The main body portion of the sanitary napkin is preferably extensible in the amounts described in PCT Publication Nos. WO 93/01785 and WO 93/01786. To summarize the same, the main body portion is preferably capable of extending between about 5% and less than about 50%, more preferably between about 10% and about 40%, and most preferably between about 25% and about 40% under the forces associated with wearing the sanitary napkin in a pair of panties. Preferably, the main body portion is capable of such extension under forces of between about 50 - 100 grams and about 1,000 - 1,500 grams, more preferably under forces of between about 250 grams and about 800 grams. Fig. 7 is a table which sets forth some additional ranges of forces for the extensibility of preferred absorbent articles. It is to be understood that all of the limits and ranges specified herein include all narrower ranges, limits, and amounts that are within the specified limits and ranges. As shown in Fig. 7, the main body portion of the sanitary napkin can also be provided with a "force wall" to prevent elongation past a certain amount without substantial increases in the amount of force applied to the main body portion. If the panty covering component is provided with an extensible portion that is fastened to the inside of the wearer's panty crotch, then the panty covering component is preferably also provided with a force wall to facilitate removal of the sanitary napkin from the wearer's panties.

[0037] The extensible portions of the panty covering component preferably are extensible in similar amounts, and in response to similar forces, as the portions of the sanitary napkin comprising the main body portion. However, any inher-

ent elasticity in the extensible portions of the panty covering component (that is, any tendency of the extensible portions to return to their original dimension) is generally relatively low. The extensible portions are also preferably extensible without being elasticized or elasticated (where separate elastic bands are stretched and attached to the panty covering component in an extensible condition). These extensible portions of the panty covering component have a relatively high "set" (compared to the values shown in Fig. 7) and a low return force so they will wrap around the edges of the wearer's panties without tending to come unwrapped from the same.

2. The Individual Components of the Sanitary Napkin and the Assembly of the Same.

[0038] The individual components which may be suitable for the various embodiments of the sanitary napkin 20 of the present invention will now be looked at in greater detail with reference to FIGS. 1-3.

A. The Topsheet

[0039] The topsheet 38 comprises a first liquid pervious component. When the sanitary napkin 20 is in use, the topsheet 38 is in close proximity to the skin of the user. The topsheet 38 is preferably as compliant, soft feeling, and non-irritating to the user's skin as possible. The topsheet 38 should further exhibit good strike through and a reduced tendency to rewet, permitting bodily discharges to rapidly penetrate it and flow toward the core 42, but not allowing such discharges to flow back through the topsheet 38 to the skin of the wearer.

[0040] The topsheet 38 has two sides (or faces or surfaces), including a body-facing side 38A and a garment-facing side (or core-facing side) 38B. The body-facing side 38A of the topsheet 38 generally forms at least a portion of the body-contacting surface ("body surface") 20A of the sanitary napkin 20. The topsheet 38 has two longitudinal edges 38C and two end edges 38D.

[0041] (A similar numbering system applies to the other components of the sanitary napkin. That is, the side of the component facing the wearer's body can be designated by the number of the component and a reference letter "A". The side facing the wearer's undergarments can be designated by the number of the component and the letter "B". The side and end edges can be designated by the number of the component and the reference letters "C" and "D", respectively.)

[0042] A suitable topsheet 38 may be manufactured from a wide range of materials including, but not limited to woven and nonwoven materials, apertured formed thermoplastic films, apertured plastic films, hydro-formed films, porous foams, reticulated foams, reticulated thermoplastic films, and thermoplastic scrims. Suitable woven and nonwoven materials can be comprised of natural fibers (e.g., wood or cotton fibers), synthetic or modified natural fibers (e.g., polymeric fibers, such as polyester, polypropylene fibers, and polyethylene, or polyvinylalcohol, starch base resins, polyurethanes, cellulose esters, nylon, and rayon fibers) or from a combination of natural and synthetic fibers. When the topsheet 38 comprises a nonwoven web, the web may be spunbonded, carded, wet-laid, meltblown, hydroentangled, combinations of the above, or the like.

[0043] Apertured films are generally preferred for the topsheet 38 because they are pervious to liquids and, if properly apertured, have a reduced tendency to allow liquids to pass back through and rewet the wearer's skin. Suitable apertured films are described in U.S. Patent 3,929,135 issued to Thompson on December 30, 1975, U.S. Patent 4,324,426 issued to Mullane et al. on April 13, 1982, U.S. Patent 4,342,314 issued to Radel et al. on August 3, 1982, U.S. Patent 4,463,045 issued to Ahr, et al. on July 31, 1984, and U.S. Patent 5,006,394 issued to Baird on April 9, 1991. A particularly suitable topsheet 38 is made in accordance with U.S. Patent 4,342,314 issued to Radel and U.S. Patent 4,463,045 issued to Ahr, et al. A topsheet 38 made of model X-3265 or model P1552 apertured formed film sold by Tredegar Corporation of Terre Haute, Indiana has been found to work well.

[0044] The topsheet 38 can be made extensible by performing a mechanical operation, such as pleating, corrugating, or ring rolling on the topsheet material to provide folds in the topsheet that are able to open when the topsheet is stretched. Such a process can be performed on many of the topsheet materials described above. In one preferred embodiment of the present invention, the topsheet 38 is made in accordance with U.S. Patent 4,463,045 and ring rolled to provide it with a degree of extensibility. Such a topsheet is described in U.S. Patent application Serial No. 07/936,195 entitled "Polymeric Web Having Deformed Sections Which Provide A Substantially Increased Elasticity To The Web", filed in the name of John J. Curro, et al. on August 25, 1992.

[0045] Suitable processes for ring rolling or "pre-corrugating" are described in U.S. Patent 4,107,364 issued to Sisson on August 15, 1978, U.S. Patent 4,834,741 issued to Sabee on May 30, 1989 and in US 5,167,897, US 5,156,793 and US 5,143,679 (collectively referred to herein as the "Ring Rolling" patent applications).

[0046] The fold lines in the corrugations of a ring rolled topsheet should run in the transverse direction so the topsheet is longitudinally extensible. In other embodiments, the fold lines could run in the longitudinal direction, both directions, and/or other directions. The topsheet 38 will be extensible in directions perpendicular to the fold lines.

[0047] In a preferred embodiment, the topsheet 38 is rendered hydrophilic so that liquids will transfer through the topsheet 38 faster. This will diminish the likelihood that body exudates will flow off the topsheet rather than being drawn

through the topsheet and being absorbed by the absorbent core. The topsheet can be rendered hydrophilic by treating it with surfactants. Suitable methods of applying surfactants are described in U.S. Patents 4,950,254 and 5,009,653 issued to Osborn.

5 [0048] In addition, in preferred embodiments, the inner surface 38B of topsheet 38 is secured in contacting relation with an underlying absorbent layer. This contacting relationship results in liquid penetrating topsheet 38 faster. The top-
sheet 38 may be kept in a contacting relationship with an underlying layer by bonding the topsheet to the underlying
layer. However, it is not absolutely necessary to bond the face of the topsheet 38 to the face of the underlying layer. The
10 topsheet 38 can be maintained in contact with an underlying absorbent component by applying adhesives between the
topsheet and the underlying component, by entangling the fibers of the underlying layer with the topsheet, by fusing the
topsheet 38 to an underlying absorbent layer by a plurality of discrete individual fusion bonds, or by any means known
in the art.

B. The Absorbent Core

15 [0049] The absorbent core 42 is positioned between the topsheet 38 and the backsheet 40. The absorbent core 42 provides the means for absorbing menses and other body fluids.

[0050] The absorbent core 42 need not have an absorbent capacity much greater than the total amount of fluid anticipated to be absorbed. The absorbent core 42 is generally compressible, conformable, and non-irritating to the user's skin. It can comprise any material used in the art for such purpose. Non-limiting examples include natural materials
20 such as comminuted wood pulp which is generally referred to as airfelt, creped cellulose wadding, hydrogel-forming polymer gelling agents, modified cross-linked cellulose fibers (such as those described in U.S. Patent 5,217,445 issued to Young, et al. on June 8, 1993, capillary channel fibers (that is, fibers having intra-fiber capillary channels such as those described in U.S. Patent 5,200,248 issued to Thompson, et al. on April 6, 1993), absorbent foams, absorbent sponges, synthetic staple fibers, polymeric fibers, peat moss, or any equivalent material or combinations of materials.

25 [0051] The polymeric gelling agents listed above may also be referred to as "absorbent gelling materials" or "super-absorbent materials". Polymeric gelling agents are those materials which, upon contact with liquids such as water or other body liquids, imbibe such liquids and thereby form hydrogels. In this manner, liquids discharged into the absorbent core 42 can be acquired and held by the polymeric gelling agent, thereby providing the articles herein with enhanced absorbent capacity and/or improved liquid retention performance. The polymeric gelling agent which is employed in the
30 absorbent core 42 will generally comprise particles 41 of a substantially water-insoluble, slightly cross-linked, partially neutralized, hydrogel-forming polymer material. The polymeric gelling agent can be in many forms, including in the form of pellets, flakes, or fibers.

[0052] In one preferred embodiment shown in Figure 2, the absorbent core 42 is a laminate. The laminate is comprised of a layer of superabsorbent polymer material, such as in the form of particles 41, disposed between two air-laid
35 tissues, first and second tissue layers (or "upper" and "lower" tissue layers) 43 and 47, respectively. The first and second tissue layers 43 and 47 provide containment of the superabsorbent polymer material, improve lateral wicking of the absorbed exudates throughout the absorbent core 42 and provide a degree of absorbency. The tissue layers 43 and 47 can be comprised of a single tissue web which is folded with the superabsorbent material particles 41 between, or two separate sheets of the same (or different) tissue.

40 [0053] A suitable laminate is a superabsorbent laminate known as WATER-LOCK L-535 available from the Grain Processing Corporation of Muscatine, Iowa (WATER-LOCK registered TM by Grain Processing Corporation). Such superabsorbent laminates are disclosed in U.S. Patent 4,467,012, issued to Pedersen et al. on August 21, 1984, U.S. Patent 4,260,443, issued to Lindsay et al. on April 7, 1981, and U.S. Patent 4,578,068 issued to Kramer, et al. on March 25, 1986. The laminate absorbent core 42 can be made extensible by cutting or slitting the same. Figure 8 shows that
45 the absorbent core 42 is a laminate as described above which is slitted or partially slitted for longitudinal extensibility.

[0054] In alternative embodiments, making the same from tissue paper having between 20% and 200% stretch (i.e., capable of extending to an extended dimension that is between about 1.2 and 3 times its unextended dimension). Such tissue sheets can be made by a number of processes. The tissue paper may in one embodiment, be conventionally creped tissue. For example, the tissue paper may be a BOUNTY tissue that is taken directly after it has been creped off
50 of a Yankee dryer before any crepe is pulled out of the tissue. A process for making such a tissue is described in U.S. Patent 5,098,522 issued to Smurkoski, et al. on March 24, 1992.

[0055] In alternative embodiments, a tissue with no or very low initial crepe can be creped after lamination. The creping process in this case could occur by passing the laminate through two matched rolls such that they would yield a corrugated laminate tissue with stretch in the range of 20% to 200%. The corrugations should be perpendicular to the
55 direction of desired stretch. In still other embodiments, the entire main body portion can be creped.

[0056] The longitudinal and end edges 22 and 24 of the main body portion 21 are preferably sealed to prevent the wicking and expulsion of liquid or liquid-containing superabsorbent material from the napkin when it is extended. Alternatively, the edges 42C and 42D of the absorbent core 42 may be sealed rather than sealing the edges of the entire

main body portion. The edges of the core 42 may, for example, be wrapped or covered by a tissue layer. In other alternative embodiments, the edges of the tissue may be folded, or otherwise manipulated to prevent the wicking and expulsion of liquid or liquid-containing superabsorbent material particles 41 from the core 42. All permanent seals around the perimeter of the main body portion should not break upon lengthening (i.e., any seal is intended to remain for the duration of the use of the sanitary napkin.)

[0057] The absorbent core 42 may be made elastically extensible even though it has no elastic properties of its own. The absorbent core 42 can be made elastically extensible by attaching it to an elastic backsheet or topsheet so that the absorbent core 42 will extend and retract with the elastic topsheet or backsheet.

C. The Backsheet

[0058] The backsheet 40 prevents the exudates absorbed and contained in the absorbent core 42 from wetting articles which contact the sanitary napkin 20 such as pants, pajamas and undergarments. The backsheet 40 is impervious to liquids (e.g., menses and/or urine). The backsheet 40 is preferably manufactured from a thin plastic film, although other flexible liquid impervious materials may also be used.

[0059] The backsheet 40 may comprise a woven or nonwoven material, polymeric films such as thermoplastic films of polyethylene or polypropylene, or composite materials such as a film-coated nonwoven material. Preferably, the backsheet 40 is a polyethylene film having a thickness of from about 0.012 mm (0.5 mil) to about 0.051 mm (2.0 mils). Exemplary polyethylene films are manufactured by Clopay Corporation of Cincinnati, Ohio, under the designation P18-1401 and by Tredegar Film Products of Terre Haute, Indiana, under the designation XP-39385.

[0060] The backsheet 40 is preferably embossed and/or matte finished to provide a more clothlike appearance. Further, the backsheet 40 may permit vapors to escape from the absorbent core 42 (i.e., the backsheet 40 may be breathable) while still preventing exudates from passing through the backsheet 40. Flushable or biodegradable backsheets can also be used, e.g., such as with the pantiliner devices described herein. Another suitable backsheet material is nonwoven/film laminate described in U.S. Patent 5,007,906 issued to Osborn April 16, 1991.

[0061] The backsheet 40 can be made extensible by performing a mechanical operation, such as pleating, corrugating, or ring rolling the backsheet material. Preferably, however, the backsheet 40 is made extensible by forming it from an elastomeric film such as the film described in U.S. Patent 4,476,180 issued to Wnuk on October 9, 1984. Such a film is obtained from Exxon Chemical Company of Lake Zurich, IL as Exxon film EXX-500 (formerly EXX-7).

[0062] Another particularly preferred extensible backsheet 40 is an extended adhesive film Formula #198-338 manufactured by the Findley Adhesives Company of Wauwatosa, Wisconsin. The Findley adhesive film is a fluid impervious film capable of extending 200 - 300%. The Findley adhesive film is preferred because it is also elastically extensible. At least one side of this film can be used with the adhesive "as is" in the sanitary napkin 20. For example, this side of the adhesive film can be adhered to the garment-facing side 42B of the absorbent core 42. The other side of the adhesive film that forms the garment-facing side 40B of the backsheet 40 may have its adhesive surface at least partially covered (or "blocked" to eliminate its adhesive characteristics). The adhesive defining the body-facing side 40A of the backsheet can also be at least partially blocked. The exposed adhesive can be blocked in a number of suitable ways. These include, but are not limited to attaching a layer of nonadhesive material to cover the exposed adhesive, and brushing or sprinkling a powdered material such as talcum powder or corn starch on at least part of the exposed adhesive. The partial blocking of the exposed adhesive on the garment-facing side 40B of the backsheet 40 can be used with the remaining exposed adhesive to create particular adhesive patterns for fastening the backsheet to the panty covering component.

[0063] In still other embodiments, an adhesive film can be created with one side that has adhesive tack, and one side without tack. One suitable adhesive film having these characteristics is a composite structure comprising a nonwoven elastomeric film with a low modulus pressure sensitive adhesive, such as adhesive film Formula #198-338 which is available with a blocking film such as film Formula H2031 from the Findley Adhesives Company. Such materials are further described (and used for other purposes) in U.S. Patent 5,032,120 issued to Freeland, et al. on July 16, 1991, and U.S. Patent 5,037,416 issued to Allen, et al. on August 6, 1991.

[0064] In other preferred embodiments, the backsheet 40 may comprise an extensible laminate structure comprised of two or more layers. The laminate can be comprised of layers which are each capable of different extensibility. For instance, a backsheet 40 can comprise a laminate formed of a layer of Findley adhesive film that is covered on one or both sides by an extensible nonwoven web or by an extensible film.

D. Combinations of Topsheet, Backsheet, and Core Materials and Assembly of the Same Into the Main Body Portion of the Sanitary Napkin.

[0065] The main body portion 21 of the sanitary napkin 20 of the present invention can be comprised of different combinations of the topsheet, backsheet, and core materials. The main body portion 21 may, as noted above, be comprised

of all extensible components. The main body portion may also be comprised of any of the other types or combinations of extensible or inextensible topsheets, backsheets and absorbent cores that are described in PCT Publication Nos. WO 93/01785 and 93/01786.

[0066] The components of the main body portion described above (the topsheet, backsheet, and absorbent core) can be assembled in any suitable manner. In the preferred embodiment shown in Figures 1-3, the components of the main body portion are assembled in a "sandwich" configuration with the components sized so that the edges of the topsheet 38 and backsheet 40 extend outward beyond the edges of the absorbent core 42. The topsheet 38 and backsheet 40 are preferably at least partially peripherally joined using known techniques. As shown in Figure 1, the topsheet 38 is preferably secured to backsheet 40 along a first seam, such as seam 90. Seam 90 is preferably liquid impervious. The seam 90 can be formed by any means commonly used in the art for this purpose such as by gluing, crimping, or heat-sealing.

[0067] The term "joined", as used herein, encompasses configurations in which an element is directly secured to another element by affixing the element directly to the other element; configurations in which the element is indirectly secured to the other element by affixing the element to intermediate member(s) which in turn are affixed to the other element; and configurations in which one element is integral with another element, i.e., one element is essentially part of the other element.

[0068] The components of the sanitary napkin 20 can be joined together by adhesives, stitching, heat and/or pressure bonds, dynamic mechanical bonds, ultrasonic bonds, intermingling or entanglement of the fibers or other structural elements comprising the components of the sanitary napkin, such as by meltblowing the fibers comprising one component onto another component, extruding one component onto another, or by any other means known in the art. Suitable means for attaching the components of the sanitary napkin are described in PCT Patent Publication No. WO 93/11725 published in the name of Cree, et al. on June 24, 1993.

[0069] When the main body portion is comprised of extensible components, the components can be joined together in any suitable manner that allows the main body portion to extend. The backsheet 40, in one example comprises a stretchable adhesive film. The core 42 is placed on top of the backsheet 40. The topsheet 38 is then placed on top of the core 42. The portions of the edges of the topsheet 38 that extend outward beyond those of the core 38 are secured to those of the backsheet 40 using the adhesive around the perimeter of the backsheet film. It has been found that such a construction adequately secures the components of the sanitary napkin without further securing the faces of the adjacent components to each other. Although, as noted above, it is often preferred to secure some of the components at their faces, as well.

[0070] The above manners of joining the components are preferred for ease of construction. (Other means of uniting the various components can be used.) For instance, the present invention also includes so-called "tube" products. In these products, a liquid pervious cover material (such as topsheet material) can be wrapped completely around the absorbent core and the backsheet, and then the components can be secured together. In alternative arrangements, the topsheet could be wrapped around the core, and the wrapped core could be placed on and secured to the backsheet.

E. The Panty Covering Component.

[0071] The panty covering component 100 comprises a pair of side wrapping elements 52 that are disposed along the longitudinal side edges of the sanitary napkin to automatically wrap the sides of a wearer's panties. The panty covering component 100 provides an alternative to conventional side flaps.

[0072] Figs. 1-5 show a preferred embodiment of the panty covering component. Before examining the features of the sanitary napkin shown in Figs. 1-5 in greater detail, the functioning of the panty covering component, in its most basic forms, will be discussed with relation to Figs. 9-15C.

[0073] Figs. 9 and 9A are simplified schematic end views of a sanitary napkin having longitudinally extensible flaps, such as the one described in U.S. Patent 4,940,462 issued to Salerno. The sanitary napkin shown in the Salerno patent suffers from several drawbacks due to the fact that the longitudinally expandable flaps extend directly outward from the longitudinal sides of the absorbent element. The expandable flaps in Salerno are attached directly to an inextensible body. This limits the extensibility of the portions of the Salerno flaps that are located adjacent to the absorbent element. In order for the Salerno flaps to extend an amount sufficient to wrap around the panty elastics, particularly if the panty crotch stretches, the flaps have to have a relatively wide transverse dimension.

[0074] Fig. 9A also shows that any laterally inward compression of the absorbent portion of the Salerno sanitary napkin will cause the flaps to be pulled inward. This can result in a loss in the ability of the flaps to cover a given area of the wearer's panties (i.e., a loss in area coverage), and may also cause the flaps to become detached from the wearer's panties.

[0075] Fig. 10 shows a first basic embodiment of the panty covering component of the present invention. The panty covering component 100 comprises side wrapping elements 52 that are extensible extensions from the longitudinal sides of an extensible sanitary napkin. The extensions are preferably extensions of non-absorbent components. The

panty covering component (or the extensible portions thereof) can, in this, like most of the other embodiments described herein, be extensible in the longitudinal direction, the transverse direction, or both. When the panties are pulled up on the wearer's body, the stretching of the portions of the panties along the leg elastics causes the extensions to naturally fold around and wrap the elastic-containing edges of the panty crotch.

[0076] In this particular embodiment, the distal edges 53 of the extensions preferably extend from about 3/8 inch (about 1 cm) to about 2 inches (about 5 cm) from the edge of the absorbent core of the sanitary napkin. The extensible extensions can be comprised of one of the components of the main body portion, or they can comprise separate elements joined to the main body portion. In one version of this embodiment, an adhesive fastener 45 may be applied to the garment-facing side of the extensions as close as about 1/8 inch (3 mm) of the distal edge of the extensions to help hold the extensions in place around the panty crotch during vigorous motions by the wearer (although such fasteners are generally not required under normal circumstances).

[0077] In alternative versions of this embodiment, the extensions can be provided with regions that are permanently extensible (that is, regions that will have no tendency to retract after extension) along any of those portions of the extension that will be disposed in the area of the panty elastics. In other alternative versions, extensions can be folded, gathered, or pinched and sealed to further facilitate wrapping the elastic-containing edges of the panty crotch. Fig. 26 shows an alternative version of such an embodiment in which the sanitary napkin is extensible and the backsheet extends beyond the edges of the topsheet and absorbent core to form the extensible extensions. In this embodiment, all of the components of the sanitary napkin are preferably at least extensible in the longitudinal direction.

[0078] The fact that the sanitary napkin is extensible at least partially alleviates some of the problems associated with the Salerno sanitary napkin. The fact that the side wrapping elements are joined to an extensible body rather than to an inextensible body, allows the side wrapping elements to continue to stay wrapped around the sides of the panty crotch even if the panty crotch stretches.

[0079] It should be understood that the "basic" embodiments described herein are directed to certain features with which the panty covering component may be provided. These features can be combined in various different ways (or omitted from) the sanitary napkin of the present invention. That is, they are not all mandatory features.

[0080] Figs. 11 and 11A show that in a second basic embodiment, the panty covering component 100 of the present invention is joined underneath to the main body portion 21 of the sanitary napkin inboard of the longitudinal side edges 22 of the main body portion. The panty covering component is otherwise unattached to the garment-facing side of the main body portion 21 of the sanitary napkin 20 between the points of attachment Q and the longitudinal side edges 22 of the main body portion. The embodiment shown in Figs. 11 and 11A allows the panty covering component 100 to stretch between the points, Q, where the panty covering component is attached to the main body portion and the place where the panty elastics will cross the panty covering component. This allows the panty covering component to mold to and fold around the wearer's panty.

[0081] Figs. 12 and 12A show that in a third basic embodiment, the panty covering component can be joined a substantial distance inward of the longitudinal side edges 22 of the main body portion 21 of the sanitary napkin 20 so that the point of attachment is located in the region of the longitudinal centerline, L. The embodiment shown in Fig. 12 provides the advantage that it reduces the tendency for the compression of the main body portion (particularly compression of the absorbent core) to interfere with the operation of the panty covering component 100. The reduction in the tendency for the compression of the core to interfere with the operation of the panty covering component 100 occurs because the panty covering component 100 is not joined near the sides 22 of the main body portion. This prevents any forces exerted on the core from directly acting on the panty covering component. Fig. 12A shows that the absorbent core can be bunched inward to the points, Q, where the panty covering component 100 is attached to the main body portion without effecting the coverage of the panty covering component 100. This can be contrasted with Fig. 9A which shows how the flaps of the Salerno sanitary napkin will bunch inward in response to such forces.

[0082] Several additional matters should be noted with regard to the embodiment shown in Fig. 12. First, the location where the panty covering component 100 is joined to the garment side 21B of the main body portion 21 is most important in the central region 32 of the main body portion (or, if the main body portion is asymmetrical, the area of the main body portion that is intended to be between the wearer's legs) because this is primarily where any bunching of the main body portion 21 will occur. The central region 32 (shown in Fig. 1) is subject to bunching because this is in the area of the narrowest portion of the panty crotch and the narrowest space between the wearer's legs, when the wearer's legs are brought together. This is particularly true for the central about 3 inches (7.6 cm) to about 6 inches (15 cm) of the main body portion.

[0083] The second matter which should be noted with regard to the embodiment shown in Fig. 12 is that such an embodiment should preferably be provided with some type of stabilizing structure in order to prevent the main body portion 21 of the sanitary napkin 20 from pitching and rolling around the longitudinal centerline relative to the panty covering component 100.

[0084] The third matter which should be noted with regard to the embodiment shown in Fig. 12 is the manner in which the side wrapping elements function differently from the flaps of known sanitary napkins. For example, sanitary napkins

are known which have flaps of various types attached inboard of the longitudinal sides of an absorbent component. Examples of such flaps are described in U.S. Patent 4,589,876 issued to Van Tilburg and U.S. Patent 4,900,320 issued to McCoy. The differences are particularly apparent with regard to the flaps of the sanitary napkin described in the McCoy patent. The flaps of the sanitary napkin described in the McCoy patent are intended to completely encircle the panty crotch and be affixed to each other. The flaps of the McCoy sanitary napkin are designed to gather the panty crotch inward. The side wrapping elements 52 of the sanitary napkin of the present invention do not overlap, nor are they designed to gather the wearer's panties. The side wrapping elements 52 are intended to adjust to the movements of the panties. That is, they move with the panties and allow the panties to move, rather than to constrain the movement of the panties as do the flaps of the McCoy sanitary napkin.

[0085] While attaching the panty covering component inboard of the longitudinal side edges of the main body portion is beneficial, additional benefits may be achieved by decoupling the main body portion from the panty covering component. The decoupling of the main body portion from the panty covering component refers to the ability of the main body portion to move away from the panty covering component in the z-direction. (For a discussion of the concept of decoupling in other contexts, reference can be made to U.S. Patent 5,007,906 issued to Osborn, et al. on April 16, 1991 and PCT Patent Publication No. WO 92/07535 published in the name of Visscher, et al. on May 14, 1992.) The decoupling of the main body portion is achieved through a decoupling component (or "isolation component" or "intermediate component") 102 that is joined at points of juncture to the main body portion and at points of juncture to the panty covering component with extra material between the two sets of points. (The points of juncture may comprise lines, zones, etc., and, as a result, may be referred to simply as "junctures".)

[0086] Three basic examples of structures capable of decoupling are shown in Figs. 13-15C (Figs. 13 and 13A; Figs. 14 and 14A; and Figs. 15-15C). Figs. 13-15C show that the extra material indirectly joins the panty covering component to the main body portion 21 of the sanitary napkin. The isolation component 102 is attached to the main body portion 21 at main body portion attachment points 110, and the isolation component 102 is attached to the panty covering component 100 at undergarment covering component attachment points 112. These three sets of figures show the various different possible relationships between the location of the main body portion attachment points and the undergarment covering component attachment points.

[0087] Figs. 13 and 13A show a first example in which the sanitary napkin is provided with a construction that allows the main body portion 21 of the sanitary napkin to decouple from the panty covering component 100. A basic way of accomplishing this is for the decoupling component 102 to comprise a single piece of material or separate strips of material that form a pair of legs 107 that join the undergarment covering component 100 to the main body portion 102. The sanitary napkin shown in Figs. 13 and 13A is characterized by the fact that the points of juncture 110 where the decoupling component 102 is joined to the main body portion 21 are inboard (i.e., closer to the longitudinal centerline) of the points where the decoupling component is joined to the panty covering component 100. The construction shown in Fig. 13A allows the main body portion 21 of the sanitary napkin to maintain close contact with the wearer's body and the panty covering component 100 to stay in the wearer's panties even when the panties move away from the wearer's body. The basic way of achieving the construction described above can be carried out in numerous different manners.

[0088] For example, in the embodiment shown in Figs. 13 and 13A, the sanitary napkin 20 can be provided with a panty covering component 100 that is in the form of a two layer laminate structure, comprising an upper layer 116 and a lower layer 118. In this embodiment, the layers of the laminate are bonded at points of attachment 112 located toward the longitudinal sides of the laminate. The layers of the laminate are unbonded between the points of attachment. This allows the unbonded portion 109 of the upper layer 116 of the laminate (and the overlying main body portion 21 of the sanitary napkin) to separate from the lower layer 118 of the laminate and the panty crotch. The structure shown in Figs. 13 and 13A provides the lateral stability needed to the embodiment shown in Fig. 12.

[0089] While the construction of the sanitary napkin is shown in Fig. 13 is suitable for allowing the main body portion to decouple from the panty covering component, as shown in Fig. 13A, a degree of bunching of the main body portion could still lead to some tendency for the side wrapping elements to be pulled inward. The embodiment shown in Figs. 13 and 13A, however, is still believed to represent an improvement over the Salerno sanitary napkin in this regard. In addition, the upper layer can be provided with transverse extensibility to reduce the tendency for the compression of the core to pull the sides of the panty covering component inward.

[0090] Figs. 14 and 14A show a second example of a decoupling feature. In this second example, the sanitary napkin 20 is provided with extra material in the form of a pair of inwardly attached legs 107 that join the panty covering component 100 to the main body portion 21. (That is, the points where the decoupling component are joined to the main body portion are outboard of the points where the decoupling component is joined to the panty covering component.) The inwardly attached legs may comprise a number of possible types of structures. For instance, as shown in Fig. 25, the inwardly attached legs can comprise a portion of one or more of the components of the sanitary napkin which is/are pleated and folded under the main body portion of the sanitary napkin and attached to the panty covering component. Alternatively, the inwardly attached legs can comprise separate elements that are connected to the main body portion of the sanitary napkin and the panty covering component. The embodiment shown in Figs. 14 and 14A provides the

advantage that the panty covering component is not subject to being pulled inward by compression of the core and the legs provide the main body portion with stability from pitching and rolling relative to the panty covering component.

[0091] Figs. 15 through 15C show a third example in which a sanitary napkin is provided with a construction that allows the main body portion of the sanitary napkin to decouple from the panty covering component. The panty covering component shown in Figs. 15 and 15A has pleated slack material between the main body portion and the panty covering component. This sanitary napkin combines the features of the embodiments shown in Figs. 13 and 14. This panty covering component can be thought of as having legs with a lower portion like that shown in Fig. 13 and an upper portion like that shown in Fig. 14. The lower portion of the connecting structure between the main body portion 21 and the panty covering component 100 helps prevent the compression of the main body portion 21 from interfering with the molding of the panty covering component 100 to the wearer's panties. The upper portion of the connecting structure allows the main body portion to be bunched or molded to the wearer's body (e.g., to assume a "W"-shape) without causing the panty covering component 100 to be pulled inward resulting in losing coverage of the panty covering component.

[0092] Figs. 15B and C show two additional versions of the type of extra material that joins the main body portion to the panty covering component. Fig. 15B shows a version having material in the form of flaccid material joining the main body portion to the panty covering component. Fig. 15C shows a version having extensible material between the main body portion and the panty covering component.

[0093] The panty covering component features shown in Figs. 15 through 15C are particularly desirable for products having thicker (e.g., greater than about 8 mm thick) main body portions. When the sides of the main body portion of the sanitary napkin are not constrained (as they are in Fig. 14), they are able to move to fit up close to the wearer's body.

[0094] The decoupling component 102 has been described above in terms of how it can interact to allow the main body portion 21 of the sanitary napkin to separate from the panty covering component in the z-direction. The decoupling component can also enhance the functioning of embodiments in which the panty covering component is joined to an inextensible main body portion. In these cases, the decoupling component is preferably provided with extensibility under the same or lesser forces than those that cause the panty covering component to extend. The decoupling component is, thus, able to serve as a stretch isolation component (or "isolation component") to allow the panty covering component 100 to extend more independently of the inextensible (or less extensible) components of the main body portion.

[0095] With the fundamental concepts and structures of the panty covering component described above in mind, the preferred embodiment shown in Figs. 1-5 will now be discussed in greater detail. The sanitary napkin shown in Figs. 1-5 comprises a panty covering component that comprises at least one sheet of extensible material 100 which is used in conjunction with an isolation element 102.

[0096] The sheet of extensible material 100 shown in Figs. 1-5 comprises a racetrack-shaped sheet of material that is larger in dimensions than the main body portion of the sanitary napkin. The panty covering component 100 may be of any suitable size and shape. For example, the panty covering component 100 may have certain dimensions that are less than or equal to those of the main body portion of the sanitary napkin. The panty covering component may be oval, rectangular, irregular, or some other suitable shape.

[0097] Figure 1 shows that portions of the sheet of extensible material 100 extend laterally outward beyond portions of the longitudinal edges 22 of the main body portion 21 of the sanitary napkin 20 in the central region 32 of the sanitary napkin 20. The portions of the sheet of extensible material 100 that extend laterally outward beyond the longitudinal edges 22 of the sanitary napkin 20 in the central region 32 provide side wrapping elements 52 that can be folded around the edges of the wearer's panties.

[0098] It should be understood, however, that while the panty covering component 100 is shown as being a single sheet of material having portions which define the side wrapping elements 52, other embodiments are also within the scope of the present invention. For instance, in alternative embodiments, the side wrapping elements 52 may each comprise one or more separate pieces attached to the main body portion 21 of the sanitary napkin. In still other alternative embodiments, the side wrapping elements 52 may be integral portions of one or more components of the main body portion. In addition, while the side wrapping elements 52 are shown as extending from each longitudinal edge of the main body portion, there may only be one side wrapping element extending from one of the edges of the main body portion. Further, the side wrapping elements are preferably mirror images of each other, and are symmetrical about the longitudinal centerline. However, it should be understood that the shape and location of the side wrapping elements described herein are those of a preferred embodiment, and other embodiments are also possible. For instance, the side wrapping elements 52 may be offset along the longitudinal centerline more towards one end edge of the main body portion than the other.

[0099] In the embodiment shown in Figs. 1-5, the sheet of extensible material 100 is preferably at least extensible in the longitudinal direction. The sheet of extensible material 100 (or any of the other panty covering components or components of the sanitary napkin described herein) can, however, be extensible only in the transverse direction, or extensible only in a direction between the longitudinal and transverse directions, or be provided with bi-directional, or multi-directional extensibility. Preferably, however, this sheet of extensible material is at least extensible in the longitudinal

direction.

[0100] The sheet of extensible material 100, as shown in Fig. 30, comprises a web material 60 with a strainable network which exhibits elastic-like behavior without added elastic materials. The web materials described herein, as, a result, may be referred to simply as the "strainable web material" (or "web material") for brevity.

5 **[0101]** The strainable web material can be used in various different forms in the panty covering component, sheet of extensible material 100. In one non-limiting example shown in Fig. 29, the sheet of extensible material 100 comprises a laminate. The laminate comprises a strainable web material secured between two longitudinally extensible, preferably carded nonwoven webs. (In addition, the strainable web material can also be used in the various other components of the absorbent article described herein.)

10 **[0102]** The strainable web material can, in a preferred embodiment, comprise a formed polymeric film. The strainable web material can be made of a base material that has a relatively low extensibility under the forces the sanitary napkin is normally subjected to when worn. When formed into the strainable web material as described herein, however, the base material, thus formed, will be extensible under these forces. The strainable web material can also be formed into a structure that provides a "force wall" to be created at specific, pre-selected elongations and forces. The strainable web material is preferably comprised substantially of linear low density polyethylene (LLDPE). The strainable web material may also be comprised of other polyolefins such as polyethylenes, including low density polyethylene (LDPE), ultra low density polyethylene (ULDPE), high density polyethylene (HDPE), or polypropylene and blends thereof with the above and other materials. Examples of other suitable polymeric materials which may also be used include, but are not limited to polyester, polyurethanes, compostable or biodegradable polymers, heat shrink polymers, thermoplastic elastomers, and breathable polymeric structures.

20 **[0103]** The strainable web material is shown in Figs. 30 and 31 in its substantially untensioned condition. The strainable web material has two centerlines, a longitudinal centerline, which is also referred to hereinafter as an axis or direction "l" and a transverse or lateral centerline, which is also referred to hereinafter as an axis or direction "t". The lateral centerline "t" is generally perpendicular to the longitudinal centerline "l". In a preferred embodiment, the longitudinal centerline l of the strainable web material is aligned with the longitudinal centerline L of the sanitary napkin. In other embodiments, however, the longitudinal centerline l of the web material can be oriented in other directions, depending on the direction of extensibility desired.

30 **[0104]** As shown in Figs. 30 and 31, strainable web material 60 includes a "strainable network" of distinct and dissimilar regions. As used herein, the term "strainable network" refers to an interconnected and interrelated group of regions which are able to be extended to some useful degree in a predetermined direction providing the strainable web material with an elastic-like, relatively low resistive force stage and a relatively high resistive force stage. The strainable network includes at least a first region 64 and a second region 66. The first and second regions each have a first surface and an opposing second surface. In the preferred embodiment shown in Figs. 30 and 31, the strainable network includes a plurality of first regions 64 and a plurality of second regions 66. The first regions 64 have a first axis 68 and a second axis 69, wherein the first axis 68 is preferably longer than the second axis 69. The first axis 68 of the first region 64 is substantially parallel to the longitudinal axis, l, of the strainable web material 60 while the second axis 69 is substantially parallel to the transverse axis, t, of the strainable web material 60. The second regions 66 have a first axis 70 and a second axis 71. The first axis 70 is substantially parallel to the longitudinal axis of the strainable web material, while the second axis 71 is substantially parallel to the transverse axis of the strainable web material. In the preferred embodiment of Fig. 30, the first regions 64 and the second regions 66 are substantially linear, extending continuously in a direction substantially parallel to the longitudinal axis of the strainable web material.

[0105] The first region 64 has an elastic modulus E1 and a cross-sectional area A1. The second region 66 has a modulus E2 and a cross-sectional area A2.

45 **[0106]** In the illustrated embodiment, a portion of the strainable web material has been "formed" such that the entire strainable web material exhibits a controlled resistive force along a predetermined axis (which in the case of the illustrated embodiment is substantially parallel to the longitudinal axis of the web material) when subjected to an applied axial elongation in a direction substantially parallel to the longitudinal axis. As used herein, the term "formed" refers to the creation of a desired structure or geometry upon the web material that will substantially retain the desired structure or geometry when it is not subjected to any externally applied elongations or forces. Suitable methods for forming a material such as the strainable web material described herein include, but are not limited to embossing by mating plates or rolls, thermoforming, high pressure hydraulic forming, or casting.

50 **[0107]** The web material used in the present invention is comprised of a strainable network of contiguous, "distinct", and "dissimilar" regions, wherein the strainable network includes at least a first region and a second region, where the first region has a "surface-pathlength" less than that of the second region. The surface pathlength is measured parallel to a predetermined axis when the material is in an untensioned state. As used herein, the term "formed portion" refers to the portion of the material which is comprised of the desired structure or geometry of the strainable network. As used herein, the term "surface-pathlength" refers to a measurement along the topographic surface of the region in question in a direction parallel to the predetermined axis. As used herein, the term "distinct" or "dissimilar" when referring to

regions, refers to regions within the strainable network having measurably different surface-pathlengths as measured parallel to a predetermined axis while the web material is in an untensioned condition.

[0108] In the preferred embodiment shown in Figs. 30 and 31, the first regions 64 comprise a substantially planar region. That is, the material within the first region 64 is in substantially the same condition before and after the formation step undergone by strainable web material. The second regions 66 include a plurality of continuous, interconnected, deformations 74 which extend alternately beyond the plane of both the first and second surfaces (64A and 64B, respectively) of first region 64. In other embodiments, the deformations 74 may extend beyond the plane of only one of either the first or the second surfaces of the first region.

[0109] The deformations 74 have a first axis 76 which is substantially parallel to the transverse axis of the web material and a second axis 77 which is substantially parallel to the longitudinal axis of the strainable web material. The first axis 76 of the deformations 74 is at least equal to, and preferably longer than the second axis 77. To enhance the two-stage resistive force versus elongation behavior characteristics of (the side flap) of the present invention, the ratio of the first axis 76 to the second axis 77 is at least 1:1, and preferably at least 2:1 or greater. In general, the greater this ratio, the more pronounced will be the two-stage resistive force versus elongation characteristic of the web material.

[0110] The first region 64 and the second region 66 each have a "projected pathlength". As used herein the term "projected pathlength" refers to length of a region as viewed perpendicularly to the surface of the web material measured parallel to the pre-determined axis (i.e., parallel to the longitudinal axis) of the strainable web material 60. The projected pathlength of the first region 64 and the projected pathlength of the second region 66 are equal to one another.

[0111] However, the first region 64 has a surface-pathlength, L1, less than the surface-pathlength, L2, of the second region 66 as measured topographically parallel to the longitudinal axis of the web material while the web material is in an untensioned condition. To enhance the two-stage resistive force versus elongation behavior characteristic of the strainable web material 60, the surface-pathlength of the second region 66 is at least about 15 percent greater than that of the first region, more preferably about 30 percent greater than that of the first region, and most preferably at least about 70 percent greater than that of the first region.

[0112] The web material 60 exhibits a modified "Poisson lateral contraction effect" substantially less than that of an otherwise identical unformed web material of the prior art. As used herein, the term "Poisson lateral contraction effect" describes the lateral contraction behavior of a material which is being subjected to an applied elongation. Preferably the Poisson lateral contraction effect of the web material of the present invention is less than about 0.4 when the web is subjected to about 20 percent elongation. Preferably, the web material exhibits a Poisson lateral contraction effect less than about 0.4 when the web material is subjected to about 40, 50, or even 60 percent elongation. More preferably, the Poisson lateral contraction effect is less than about 0.3 when the web material is subjected to 20, 40, 50, or 60 percent elongation.

[0113] For the strainable web material, the direction of applied axial elongation, indicated by arrows 80, is substantially perpendicular to the first axis 76 of the deformations 74. (The amount of axial elongation is distance, D.) As the deformations 74 are able to extend in a direction substantially perpendicular to their first axis 76, the direction of applied axial elongation to cause extension in strainable web material is also substantially perpendicular to the first axis 76 of the deformations 74.

[0114] While the direction of applied axial elongation, indicated by arrows 80, is substantially perpendicular to the first axis 76 of the deformations 74, an applied axial elongation having a longitudinal component will cause the strainable web material to extend in the direction of applied axial elongation.

[0115] In Fig. 34 there is shown an exemplary graph of a resistive force-elongation curve 720 of a formed polymeric web material of the present invention along with a similar curve 710 for a planar, base polymeric film from which the web material is formed. Referring now to the force-elongation curve 720, there is an initial substantially linear, lower force versus elongation stage I designated 720a, a transition zone designated 720b, and a substantially linear stage II designated 720c which displays substantially higher force versus elongation behavior, corresponding to a resistive force wall beyond which the web material may undergo additional permanent deformation.

[0116] As seen in Fig. 34 a formed web material having a strainable network exhibits a controlled multi-stage behavior when subjected to an applied elongation in a direction parallel to the longitudinal axis of the web material. The resistive force to the applied elongation is significantly different between stage I (720a) and stage II (720c) of curve 720 as compared to curve 710 which does not exhibit this behavior. Referring now to Fig. 32, as the web material is subjected to an applied axial elongation indicated by arrows 80 in Fig. 30, the first region 64 having the shorter surface-pathlength, L1, provides most of the initial resistive force, P1, to the applied elongation which corresponds to stage I. While in stage I, the deformations 74 in the second region 66 are mostly out of the plane of applied elongation and offer minimal resistance to the applied elongation. In the transition zone between stages I and II, the deformations 74 are becoming aligned with the applied elongation. In stage II, as seen in Fig. 33, the deformations 74 in the second region 66 have become substantially aligned with the plane of applied elongation and begin to resist further elongation. The second region 66 now contributes a second resistive force, P2, to further elongation. The first and second resistive forces to elongation provide a total resistive force, PT, which is greater than the resistive force provided by the first region 64. Accordingly,

the general slope of the force-elongation curve in stage II displays the characteristics of a force wall that is significantly greater than the general slope of the force-elongation curve in stage I.

[0117] The resistive force P1 is substantially greater than the resistive force P2 when (L1+D) is less than L2. While (L1+D) is less than L2 the first region 64 provides an initial resistive force, P1, generally satisfying the equation:

$$P1 = \frac{(A1 \cdot E1 \cdot D)}{L1}$$

[0118] When (L1+D) is greater than L2 the first and second regions provide a combined total resistive force, PT, to the applied elongation D, generally satisfying the equation:

$$PT = \frac{(A1 \cdot E1 \cdot D)}{L1} + \frac{(A2 \cdot E2 \cdot |L1 + D - L2|)}{L2}$$

[0119] (Where "*" represents a multiplication sign.)

[0120] The maximum elongation occurring while in stage I is considered to be the "available stretch" of the web material. The available stretch can be effectively determined by inspection of the force-elongation curve 720, the approximate point at which there is an inflection in the transition zone between stage I and stage II is the percent elongation point of "available stretch". The range of available stretch can be varied from about 10% to 100% or more; this range of elastic-like response is often found to be of interest in disposable absorbent articles, and can be largely controlled by the extent to which surface-pathlength L2 in the second region 66 exceeds surface-pathlength L1 in the first region 64 and the properties of the base film. Significantly higher forces are required to achieve percent elongations in the base film equivalent to those percent elongations in the web 60. The approximate extent of stage I can be controlled as desired by adjusting the pathlengths, L1 and L2 in an untensioned condition. The force-elongation behavior of stage I can be controlled by adjusting the width, thickness, and spacing of first region 64 and the properties of the base film.

[0121] When the web material of Fig. 30 is subjected to an applied elongation, the web material exhibits an elastic-like behavior as it extends in the direction of applied elongation and retracts to its substantially untensioned condition once the applied force is removed, unless extended to the point of yielding. The web material is able to undergo multiple applications of applied elongation without losing its ability to substantially recover. Accordingly, the web material is able to retract to its substantially untensioned condition once the applied elongation or force is removed.

[0122] While the web material may be easily and reversibly extended in the direction of applied axial elongation, in a direction substantially perpendicular to the first axis 76 of the deformations 74, web material 1s relatively non-extensible in a direction substantially parallel to the first axis 76 of the deformations 74. The plastic deformation imparted upon the deformations 74 allows the deformations to be extended in one direction, in a direction substantially perpendicular to the first axis of the deformations, while being relatively non-extensible in a direction substantially perpendicular to the direction of extension, in a direction substantially parallel to the first axis of the deformations. In other embodiments, the strainable web material 60 can be provided with first regions 64 that extend outward from a center and second regions 66 that are disposed in concentric circles around the center to make the strainable web material 60 extensible in more than one direction.

[0123] The amount of applied force required to extend the web material is dependent upon the inherent properties of the base material forming the web material and the width and spacing of the undeformed regions 64, with narrower and more widely spaced undeformed regions 64 requiring lower extensional forces to achieve the desired elongation. The first axis 68, (i.e., the length) of the undeformed regions 64 is preferably greater than the second axis 69, (i.e., the width) with a preferred length to width ratio of between 5:1 and 300:1.

[0124] The depth and number of deformations 74 can also be varied to control the applied force or elongation required to extend the web material of the present invention. In one preferred embodiment, the deformations are formed by two rigid plates having outer dimensions of 5.0" by 12" by 0.75". On one surface of each plate are a series of meshing teeth which are substantially triangular in cross section and measure 0.030" at their bases and taper to a vertex with a radius of 0.008" at the top. The centerlines of the teeth are spaced evenly and at 0.030" increments. On the "toothed" side of one plate, a series of grooves are cut which are parallel to each other and perpendicular to the evenly spaced teeth. These grooves measure 0.031" wide and are continuous over the entire length of the plate, and are spaced at a distance of 0.25" on center. These grooves correspond to the undeformed regions of the deformed web of material.

[0125] The preferred LLDPE base material is placed between the plates in a hydraulic press having platens larger than the plates to evenly distribute pressure. The plates are compressed under a load of at least 4,000 pounds. The formed web material is then removed from between the plates. The available stretch or elongation is increased if for a given number of deformations, the height or degree of deformation imparted on the deformations is increased. Similarly,

the available stretch or elongation is increased if for a given height or degree of deformation, the number or frequency of deformations is increased.

[0126] The sheet of extensible material 100, as noted above, comprises side wrapping elements 52. The side wrapping elements 52 are smaller than conventional flaps. (That is, the side wrapping elements do not have as great a span from distal edge to distal edge.) Preferably, the size of the side wrapping elements relates to the size of the crotch region of the wearer's panties. Panties have crotch widths that average about 65-70 mm (about 2 3/4 inches) measured at the narrowest point of the crotch. Panties come in a wide variety of sizes, however. The width of panty crotches can range from about 2 inches (about 5 cm) to about 4 1/2 inches (about 11.4 cm). The smallest span of conventional flaps is believed to be about 5 inches (about 12.7 cm) for small tab-like flaps that are on some current products.

[0127] With these factors in mind, the width of the side wrapping elements should not be large enough to overlap when they fold under the wearer's panties. The dimensions of the side wrapping elements can be expressed in terms related to the boundaries of main body portion of the sanitary napkin. For instance, the span of the side wrapping elements 52 can be expressed in terms of the perpendicular distance in the x-y plane, D_1 , from the most inward point on the longitudinal side edge of the main body portion (i.e., the point closest to the longitudinal centerline) R to the distal edge 53 of the side wrapping elements 52. The side wrapping elements 52 preferably extend a distance that is less than or equal to about 1 1/4 inch (about 3 cm) from the most inward portion of the main body portion of the sanitary napkin. More preferably, the side wrapping elements extend less than or equal to the following distances from the most inward point on the main body portion: about 1 inch (about 2.5 cm), about 3/4 inch (about 2 cm), about 1.5 cm, and about 0.5 inch (about 1.25 cm).

[0128] The span of the side wrapping elements 52 can alternatively be specified in absolute terms of the distance from the distal edge to distal edge when the side wrapping elements 52 are extended laterally in opposite directions. Expressed in this manner, the span of the side wrapping elements from one distal edge to the other (and, thus also the span of the panty covering component) is preferably less than about 5 inches (about 12.7 cm) more preferably less than or equal to about 4 3/4 inches (about 12 cm). The minimum span of the side wrapping elements should be greater than or equal to any of the following amounts provided the span is also greater than the width of the panty crotch: about 2 1/2 inches (about 6.4 cm); about 3 inches (about 7.6 or 8 cm); or about 3 1/2 inches (about 9 cm). A preferred range for the span of the side wrapping elements is between about 3 1/2 inches to about 4 3/4 inches. Even more preferably, the side wrapping elements have a span of between about 4 inches (about 10 cm) to about 4 1/2 inches (about 11.5 cm).

[0129] The side wrapping elements 52 can have a length (longitudinal dimension) that varies within a large range.

The length of the side wrapping elements 52 is preferably at least as large as the longitudinal dimension of known types of flaps (such as those described in the Background of the Invention) that attach to each other or to the underside of a wearer's panties. The side wrapping elements, therefore, can extend primarily from the central region of the main body portion of the sanitary napkin. Alternatively, the side wrapping elements can have a length that is as long as, or longer than, the length of the main body portion. Providing the sanitary napkin with side wrapping elements that are shorter than the length of the main body portion, however, may be preferred from a cost standpoint since such a sanitary napkin will require less material to make.

[0130] The panty covering component 100 should have additional features in order to automatically wrap the edges of the wearer's panties and stay in place around the same. For example, at least portions of the sheet of extensible material 100 preferably comprise a material having a low return force and a high set. These are materials that, when stretched, will not tend to return all the way to their unstretched dimensions. They will tend to remain (or set) close to their extended dimensions.

[0131] When the side wrapping elements 52 comprise a material having a high set, they will stretch to fit around the crotch of the wearer's panties. The high set reduces the tendency of the side wrapping elements 52 to retract and bunch the wearer's panties, or to unfold from the underneath the panties.

[0132] The term "set", as used herein, refers to the amount of permanent deformation (as a percentage of the original sample length) remaining in a sample after application and removal of the indicated strain. The procedure and equipment are described in the following. (Unless otherwise specified, all tests described herein are performed on samples that have been conditioned by leaving them in a room at 50% relative humidity and at 73° F for a period of two hours prior to the tests.)

[0133] The set of a material is determined by pulling a 1" wide x 4" long (2.5 cm x 10 cm) sample of the material to a given strain in an Instron model testing apparatus 1122, using a crosshead speed of 10 in/min. (25 cm/min.). The sample is mounted in the Instron grips so that the axis of elongation is parallel to the long dimension of the sample. The gage length of the sample (distance between gripping points is 2" {5 cm}). The strain used for this particular test is 30% (i.e., a 2" {5 cm} sample is pulled to 2.6" {6.6 cm}) and is held for thirty seconds at that strain. The separation between the grips is then returned to 2" (0% strain on the sample) and held at this position for 60 seconds. This cycle is then repeated. The percent set is determined as the first point on the strain axis where the force to elongate is greater than zero during the second cycle. This is illustrated in Figure 27. An average percent set for three samples is reported. The material comprising the extensible material preferably has a set greater than or equal to 10% strain and more preferably

has a set greater than or equal to 15%, 20%, 25%, or 30% strain (at 30% set all deformation is permanent).

[0134] The side wrapping elements 52 preferably also have several properties which allow them to wrap the sides of the wearer's panties and stay folded around the panty elastics without unfolding. These properties are low return force, resistance to edge compression and fold retention.

5 **[0135]** Return force is measured as follows: A 1" x 4" long (2.5 cm x 10 cm) sample is cut from the material to be tested so that the long axis of the sample is in the direction of lowest modulus (highest extensibility at lowest force) of the material. The sample is then mounted in a fixture comprising a force gauge, a steel rule for measuring extension of the sample and two clamps to hold the sample separated by a distance of 2" (5 cm) (the gauge length). One of the clamps is attached to the force gauge and the other is attached to a lab jack which can be raised and lowered. The
10 entire apparatus is placed in an oven set at a temperature of 98°F (37°C), and the sample is clamped between the two grips. The sample is pulled to 30% strain (2.6" e.g. 6.6 cm) and held at this position for 5 minutes. The strain on the sample is then reduced to 25% and the force on the force gauge is reported as the return force at 25%. This is to simulate the temperatures and strains placed on a material during wearing of the product. The average return force of three samples is reported. The return force should be less than or equal to about 100 grams, preferably less than or equal to
15 about 50 grams, and most preferably less than or equal to about 25 grams.

[0136] The "resistance to edge compression" refers to the measurement of how substantial the material is that comprises the side wrapping elements. Specifically, edge compression refers to the tendency of the material comprising the side wrapping elements 52 to buckle when the side wrapping elements are extended to form a planar extension and forces are applied perpendicular to the plane of the side wrapping elements. The resistance to edge compression can
20 be measured by placing a plate or block 115 perpendicular to the distal edge 53 of the side wrapping element 52 and applying a force with the block perpendicular to the plane of the side wrapping elements. This property is important because if the material comprising the side wrapping elements is insubstantial, it will bunch up when forces are applied by the wearer's panty elastics to the side wrapping elements during wear. The side wrapping elements preferably have a resistance to edge compression of greater than or equal to about 5 grams, more preferably greater than or equal to
25 the following amounts: about 7 grams; about 10 grams, and about 15 grams.

[0137] The edge compression test uses the Instron Model 1122 equipped with a compression load cell which is interfaced with Testworks™ software made by Sintech, Inc., and run on a Gateway 486/33Hz computer. All of the parameters for testing are specified in the computer program, for example the crosshead speed, the strain up and the strain down. Also, all the data collection, data analysis and graphing are done by Testworks.

30 **[0138]** A 9 mm by 25 mm sample is cut from the panty covering component so that the distal edge 53 of the side wrapping element is parallel to the 25 mm long edge of the sample. The sample is glued on its long edge in an upright position to a glass slide (i.e., perpendicular to the face of the slide). The glass slide is called the sample holder. The sample and holder are placed on a platform on top of the crosshead. The crosshead speed is set for 10 in/min (25 cm/min). A T-bar is attached to the compression cell and the crosshead is raised until a load of 0.5 grams is placed on the sample.
35 The gage length is set to zero at this point and the crosshead continues to move up to a distance of 3 mm. The crosshead then returns to zero extension and the cycle is repeated. The maximum force of the two cycles is recorded and the average of five samples is reported as the Edge Compression Force. This is shown In Figure 28.

[0139] The "fold retention" refers to the ability of the side wrapping elements to stay in place after they have been folded around a panty crotch. Fold retention is measured by the following procedure. A side wrapping element is first
40 folded around a panty crotch. The folded side wrapping element is then placed folded side upward on a flat surface. A 105 gram weight is placed on the side wrapping element for a period of 5 minutes. Also, this test is run at 98°F. The weight is removed, and the side wrapping element is allowed to unfold (if there is any tendency for it to do so). The amount, if any, the side wrapping element has unfolded is measured by measuring the angle formed between the side wrapping element and the flat surface after 30 seconds following the removal of the weight. The smaller the angle the
45 side wrapping element makes with the flat surface, the better fold retention the side wrapping element has. The side wrapping elements preferably have a fold retention measured in the foregoing manner of less than or equal to about 100°, more preferably less than or equal to about 90°, and still more preferably, less than or equal to about 45°, and most preferably less than or equal to about 20°.

[0140] In a particularly preferred embodiment, the side wrapping elements can be at least partially comprised of a material, with a "dead fold" property such as aluminum foil or SARAN wrap so the side wrapping elements will have very little tendency to unfold after being folded.
50

[0141] The panty covering component 100 in the preferred embodiment shown in Figs. 1-5 is used with an isolation element 102. The isolation element 102 provides the sanitary napkin with slack material between the main body portion 21 and the panty covering component. This allows the panty covering component 100 to decouple so the main body
55 portion may move closer to the body when panties pull away from the body.

[0142] The isolation element 102 can also be used to connect the sheet of extensible material 100 to an inextensible component of the main body portion of the sanitary napkin (or to a component that is less extensible than the sheet of extensible material 100). This is important when it is desired to create a sanitary napkin that stretches with the wearer's

panties when one or more of the components of the main body portion are either relatively inextensible or less extensible than the wearer's panties. If the isolation element 102 serves this purpose, the isolation element can comprise any suitable type of component that allows the sheet of extensible material 100 to extend more independently of the less extensible components than if such an element were not present. The isolation element, thus, can be said to "isolate", "disassociate", or "decouple" the extensibility of the sheet of extensible material 100 from the inextensible components of the sanitary napkin.

[0143] Figs. 1-5 show an embodiment in which the isolation element 102 is in the position of the backsheet 40 of the sanitary napkin 20. The isolation element 102 shown in Figs. 1-5 preferably comprises a nonwoven web that is extensible at least in the longitudinal direction. The main body portion of the embodiment shown in Figs. 1-5 preferably has a liquid impervious barrier (not shown) between the absorbent core and the isolation component. In other embodiments, the sanitary napkin 20 may have a conventional backsheet, and the isolation element 102 may comprise a separate component that is attached to the backsheet 40. The isolation element 102 may be liquid pervious if it is used in addition to a backsheet. The isolation element can, however, replace the backsheet in other embodiments. The isolation element 102 is preferably liquid impervious if it replaces the backsheet.

[0144] The panty covering component (or sheet of extensible material 100 in Figs. 1-5) should, as discussed above, preferably be joined to the main body portion 21 of the sanitary napkin (or in the case of the embodiment shown in Figs. 1-5, to the isolation element 102) at certain discrete points. The sheet of extensible material 100 can be joined to the isolation element 102 by any suitable attachment mechanism. Suitable attachment mechanisms include, but are not limited to adhesives, and the like.

[0145] Fig. 1 shows one way the sheet of extensible material 100 may be attached to the isolation element 102. The attachment mechanism 108 comprises a large zone of adhesive 104 disposed along a portion of the longitudinal centerline L, and smaller adhesive areas 106 in the corners 27 of the sanitary napkin 20. These adhesives can be extensible or inextensible. The large zone of adhesive 104 can comprise adhesive in any suitable pattern. The large zone of adhesive 104 can comprise one or more strips, patches, spots, or lines of adhesive. The strips (or the like) of adhesive within the large zone 104 can be intermittent or continuous. The length and width of the large zone of adhesive 104 can range in size. The length of the large zone of adhesive 104 can range in size from a small patch located along the transverse centerline T to a zone that extends nearly the length of the sanitary napkin. The large zone of adhesive in the embodiment shown is about 6 inches (about 15 cm.) long. The large zone of adhesive 104 can range from very narrow to fairly wide. The width of the large zone of adhesive 104 can be so small that it is just a thin line of adhesive disposed along the longitudinal centerline. The following discussion describes some of the factors involved in choosing the configuration of the attachment mechanism, such as the large zone of adhesive 104 and smaller adhesive areas 106.

[0146] There are many possible alternative configurations of attachments between the panty covering component and the main body portion of the sanitary napkin. Several configurations for the attachment mechanism are shown in Figs. 17-20. (Figs. 17-20 also show several examples of panty covering components that are shorter in the longitudinal dimension than the main body portion of the sanitary napkin.) Fig. 17 shows an attachment mechanism 108 that is in the form of a rectangular zone or block that is centered about the longitudinal centerline. Fig. 18 shows an attachment mechanism 108 that is in the form of two strips that extend in the longitudinal direction. The strips are on opposite sides of the longitudinal centerline. The strips can be in any suitable configuration that extends generally in the longitudinal direction. Suitable configurations include, but are not limited to linear strips, curvilinear strips, intermittent strips, and the like. The strips are located near, but inward from the longitudinal side edges 22 of the main body portion 21.

[0147] Fig. 19 shows an attachment mechanism 108 that is in the form of two strips that extend in the transverse direction. The strips are on opposite sides of the transverse centerline. These strips are preferably located at the transverse end edges 100D of the panty covering component. Fig. 20 shows an attachment mechanism that is in the form of a block letter "I" which has two strips similar to those shown in Fig. 19 and a central strip that runs down the longitudinal centerline connecting the two transverse strips. The attachment patterns in Figs. 19 and 20 have the advantage that they can permit the main body portion 21 of the sanitary napkin to decouple from the panty covering component and also permit the main body portion to bunch inward in the central region 32 of the main body portion without pulling the panty covering component inward.

[0148] Returning to the discussion of the preferred embodiment shown in Figs. 1-5, there are several factors which are preferably taken into account in designing the isolation element 102. When such an embodiment is provided with a main body portion that is generally inextensible, a key dimension to the proper functioning of the panty covering component embodiment shown therein is the dimension D_2 (shown in Figure 1). The dimension D_2 can be measured longitudinally or laterally, as shown in Fig. 1. The dimension D_2 is the distance from the place where: (a) the isolation element 102 is bonded to any inextensible components of the sanitary napkin, point P, to the place where (b) the isolation element 102 is bonded to the sheet of extensible material 100, point Q. (In this embodiment, if the main body portion comprises inextensible or less extensible components, the isolation element 102 would be bonded to any inextensible components of the sanitary napkin at the seam 90 around the perimeter of the sanitary napkin.)

[0149] The dimension D_2 is important because it affects the amount that the extensibility properties of the sheet of

extensible material 100 and the main body portion of the sanitary napkin 20 can be decoupled. The dimension D_2 required for a particular sanitary napkin depends on the relative extensibility of the materials comprising all of the relevant portions of the sanitary napkin. The portions of the sanitary napkin relevant to the dimension D_2 include, but are not limited to the inextensible components, the sheet of extensible material 100, and the isolation element 102. For instance, if the isolation element 102 is extremely extensible, the isolation element 102 will not need a great D_2 dimension to create a sufficient amount of slack between the sheet of extensible material and the inextensible components.

[0150] The dimension D_2 will also depend on the dimensions of the attachment mechanism used to attach the sanitary napkin 20 to the wearer's panties. This is because the slack material can also be present in the portion of the sheet of extensible material 100 between the edge of the panty fastener and the place where the sheet of extensible material 100 is joined to the isolation element 102. Preferably, in the embodiment described herein, D_2 is greater than or equal to about 5 mm, more preferably greater than or equal to about 10 mm, more preferably, and most preferably is greater than or equal to about 15 mm. The upper limit on D_2 is as follows. D_2 is preferably not so large that point Q extends past the intersection of the centerlines of the sanitary napkin, point I.

[0151] Figures 4 and 5 show what happens when the sanitary napkin 20 with the panty covering component 100 shown in Figs. 1-3 is stretched. The sheet of extensible material 100 stretches with the wearer's undergarments U. Figure 4 shows that the end regions 28 and 30 of the sanitary napkin 20 will curve upward when the sanitary napkin is viewed from the side. This will provide the sanitary napkin an overall curved longitudinal profile. Figure 5 shows that the sanitary napkin 20 is saddle-shaped when viewed from the end. The particular curvature shown in FIGS. 4 and 5 results from the configuration of the attachment mechanism between the sheet of extensible material 100 and the isolation element 102. Other attachment mechanisms may be used to create other stretched configurations.

[0152] The panty covering component (as noted above) automatically wraps around the sides of the wearer's panties by the simple action of the wearer pulling up her panties. There are several additional matters which should be kept in mind relating to the features of the panty covering component.

[0153] First, placing a sanitary napkin having conventional flaps in a pair of panties and pulling up the panties will not consistently provide the automatic sustained wraparound feature of the present invention. There are several reasons for this. The conventional flaps are not extensible, so they will not conform to the panties. Conventional flaps are not provided with a low return force and a high fold retention, so that in cases where conventional flaps wrap around the panties, they do not consistently stay. In addition, conventionally-sized flaps will have excess flap material that hangs down underneath the panties during wear. This material can move around excessively underneath the panties. The side wrapping elements of the present invention, on the other hand, have a span that is ideally just wide enough to wrap around the elastic-containing edges of the panties, but no wider. The size of the side wrapping elements, combined with the extensibility of the same, reduces any tendency for the side wrapping elements to bunch longitudinally inward during wear.

[0154] The second matter which should be kept in mind is that the portions of the panty covering component located outboard of the longitudinal ends of the side wrapping elements that do not wrap around the edges of the panties can also serve an important function. These portions, end portions (or "non-wrapping portions") are shown as 52' in Fig. 1. The sanitary napkin is preferably constructed so these non-wrapping portions 52' can naturally work their way into the area of the wearer's leg crease to provide a gasketing effect against the wearer's body. This is believed to provide the wearer with extra protection from soiling of the wearer's panties (even in these areas) where the panty covering component does not cover the panty elastics. This is particularly true when the panty covering component is between about 150-200 mm long, or when the panty covering component is up to about 90% of the length of the main body portion for sanitary napkins having main body portions longer than 200 mm.

[0155] The gasketing benefits of the non-wrapping portions 52' is believed to be attributable to several factors associated with the construction of the sanitary napkin. When the side wrapping elements 52 are wrapped around the edges of the panties, the non-wrapping portions 52' are held in tension. The non-wrapping portions 52' are held at one end by the panty elastic, and at the other end by the smaller adhesive areas 106 in the corners 27 of the sanitary napkin. This causes the non-wrapping elements to stand more upright to form these gasket-like structures, rather than to simply flop over.

[0156] The benefits provided by the non-wrapping portions are enhanced when the panty covering component has a nonwoven body-facing side. When the panty covering component has a nonwoven body-facing side, this provides the panty covering component with a "skin friendly" surface that is desirable for contacting the wearer's body when the non-wrapping portions serve their gasketing function.

[0157] The panty covering component, as noted above, may provide an extensible (or stretchable) interactive connection between the main body portion of the sanitary napkin and the wearer's undergarments. The panty covering component 100 is particularly useful in providing a generally inextensible sanitary napkin with the ability to adapt to the stretching of the wearer's undergarments. The panty covering components are also useful in providing the other benefits of extensibility described herein. The panty covering component 100 can be stretchable, and therefore, it can be considered to be a variety of a stretchable attachment device as described in PCT Publication No. 93/01785.

[0158] FIGS. 29, 35, and 36 show several specific non-limiting examples of sanitary napkin embodiments having a panty covering component comprising the strainable web material which exhibits elastic-like behavior without added elastics that is described above.

[0159] FIG. 29 is a schematic cross-sectional view taken from an angle similar to that of FIG. 2 which shows a sanitary napkin embodiment having a panty covering component comprising a laminate of two nonwoven webs and a strainable web material which exhibits elastic-like behavior without added elastics. The strainable web material preferably has its longitudinal axis aligned in the longitudinal direction. (In other less preferred embodiments, however, the longitudinal axis of the web material may be aligned in the transverse direction, or some direction between the longitudinal and transverse directions. In still other embodiments, the web material may be extensible in more than one direction as described herein.)

[0160] Various types of nonwoven webs can be used with the strainable web material. The nonwoven webs preferably comprise either a carded, thermally bonded, polypropylene nonwoven web having a basis weight of 19.6 g/square yard obtained from Veratec of Walpole, Mass. which is referred to internally as P-8, or a carded thermally bonded polypropylene nonwoven web having a basis weight of 23 g/square yard, also available from Veratec, which is embossed with the pattern described in U.S. Patent 4,781,710 issued to Megison on November 1, 1988, and which is referred to internally as P-11.

[0161] The layers of the laminate may be joined together in any suitable manner which provides the laminate with the desired extensibility. As shown in FIG. 29, the individual layers of the laminate are joined together by adhesives applied between the strainable web material and each nonwoven web in the embodiment. The adhesives used for this purpose can be any suitable type of adhesive, and may be either inextensible or extensible. Inextensible adhesives can be used if they are applied in a pattern which is suitable for providing the laminate with extensibility. In the particular embodiments shown in the drawings, the adhesive is an elastomer-based, pressure sensitive, extensible adhesive #2031 available from Findley Adhesives of Wauwatosa, WI. which is applied in a spiral pattern.

[0162] Suitable forms of adhesive application are the open pattern network of adhesive filaments disclosed in U.S. Patent 4,573,986 issued to Minetola, et al. on March 4, 1986; or, the open pattern network of filaments comprising several lines of adhesive filaments swirled into a spiral pattern as illustrated by the apparatus and method shown in U.S. Patent 3,911,173 issued to Sprague, Jr. on October 7, 1975; U.S. Patent 4,785,996 issued to Zieker, et al. on November 22, 1978; and U.S. Patent 4,842,666 issued to Werenicz on June 27, 1989.

[0163] The areas of the layers to which adhesive is applied in each of the embodiments shown in FIGS. 29, 35, and 36, are similar. The uppermost nonwoven layer 126 is split into two longitudinally-oriented portions. The ends 126C' of the longitudinally-oriented portions closest to the longitudinal centerline of the sanitary napkin are folded back as shown to create marginal areas 130 that are attached to the main body portion 21. A longitudinally-oriented band of adhesive 132 is applied in a spiral pattern to adhere each longitudinally-oriented marginal area 130 to the main body portion 21 adjacent to the longitudinal edges 22 of the main body portion 21. The other end 126C" of the longitudinally-oriented portions that form the uppermost nonwoven layer is secured to a region of the strainable web material by second bands of adhesive 134 that run along the longitudinal side edges 60C of the strainable web material. The lower nonwoven web 128 is adhered to the garment-facing side 60B of the strainable web material 60 of the embodiments shown in FIGS. 29 and 36 by a spiral pattern of adhesive 136 that covers essentially the entire garment-facing side 60B of the strainable web material 60.

[0164] FIG. 35 is a schematic cross-sectional view of another embodiment of a sanitary napkin in which a single nonwoven web is wrapped around the strainable web material to form the panty covering component of the sanitary napkin. In this embodiment, the strainable web material 60 is preferably stretched and the nonwoven material is attached to the strainable web material 60 while the strainable web material is in an extended condition. In the embodiment shown in FIG. 35, the nonwoven web does not completely cover the garment-facing side 60B of the strainable web material 60. In this case, the second spiral application of adhesive can be omitted from the exposed portion of the garment-facing side 60B of the strainable web material, or it can be applied to the exposed garment-facing side 60B of the strainable web material 60 and used as a panty fastening adhesive. In fact, applying panty fastening adhesive in a spiral pattern is one preferred way of placing adhesive onto a material which has deformed portions like the strainable web material.

[0165] There are several advantages of the construction shown in Fig. 35. One advantage of wrapping the nonwoven web around the strainable web material 60 is that it provides the panty covering component with a loop of material 140 along the sides that provides soft, comfortable edges. The wrapping of the edges 60C of the web material also adds bulk to these edges to increase the strength and resistance to edge compression. This is important because the strainable web material 60 per se is extremely flexible, and will tend to fold upon itself along its first undeformed regions 64 when it is used in the panty covering component unless it suitably reinforced.

[0166] Further, leaving part of the garment-facing side exposed has the additional advantage of requiring the use of less nonwoven material, thus, saving material costs. This configuration also allows the side wrapping elements to be provided with extensibility regardless of the direction the nonwoven material is oriented in (and regardless of how extensible the nonwoven material is). This latter advantage is possible since the laminate formed thereby will be primarily

extensible by virtue of the extensibility of the strainable web material. The nonwoven is attached to the strainable web material when the strainable web material is stretched. Upon release of the tension on the strainable web material, puckered areas (or rugosities) are formed in the nonwoven material. When the laminate is stretched, the web material stretches and the puckered areas in the nonwoven web will straighten out to provide the desired extensibility.

- 5 **[0167]** FIGS. 36 and 37 are a schematic cross-sectional view of a sanitary napkin provided with the panty covering component which is provided with edge stiffening members 150 and a plan view of the panty covering component by itself, respectively. The edge stiffening members 150 comprise one or more elements that are positioned near the longitudinal edges 100C of the panty covering component 100 that reduce the tendency for the side wrapping elements 52 to bunch, creep, or roll. The aforementioned terms refer to undesirable potential tendencies for the side wrapping elements 52 to compress inward, curl back inside the panty elastics, or curl up after they have initially wrapped around the panty elastics. These tendencies, as noted above, increase when the panty covering component has the web material as one of its components due to the high flexibility of the same about its undeformed regions. These tendencies increase when frictional forces and other forces are applied to the side wrapping elements by the wearer's body and clothing when the wearer walks or otherwise moves about.
- 10 **[0168]** The edge stiffening members 150 can comprise any suitable type of element that reduces the above undesirable tendencies to which the side wrapping elements are subjected. The edge stiffening members may, but need not be located at the exact edges 100C of the panty covering component. The edge stiffening members need only be adjacent to the longitudinal side edges 100C of the panty covering component. The edge stiffening members may be oriented in the transverse direction, the longitudinal direction, or some direction between the longitudinal and transverse directions.
- 15 **[0169]** The edge stiffening members should resist buckling, but be flexible enough that they do not interfere with the stretching of the side wrapping elements 52 and the wrapping of the same about the wearer's panties.
- 20 **[0169]** The edge stiffening members can be of any suitable shape. The edge stiffening members can be separate elements that are attached to the panty covering component, or they can be integral with the panty covering component. If the edge stiffening members are separate elements, they can be attached to the panty covering component by any suitable means, such as by adhesives. The edge stiffening members can be formed as integral components of the panty covering component by mechanical means such as by crimping the strainable web material and/or any other materials in the panty covering component using heat and/or pressure. Alternatively, the edge stiffening members can be formed by either deforming portions of the strainable web material so that stiffer areas are formed into the same, or by eliminating the deformed and/or undeformed regions from areas of the strainable web material.
- 25 **[0170]** The edge stiffening members are shown in FIG. 37 as comprising three transversely-oriented resilient pieces of foam positioned along each longitudinal side edge of the panty covering component. The transverse strips of foam comprise a central strip of foam that is preferably located along the transverse centerline of the panty covering component and two outer strips of foam spaced about 1 inch (about 2.5 cm) away from the central strip of foam. One preferred foam material for the edge stiffening members comprises a polyethylene foam known as VOLARA 2a obtained from Voltek Corp., Lawrence, Mass. The strips are each about 1/8 inch (about 0.32 cm) wide. The central strip is about 1 inch (about 2.5 cm) long, and the outer strips are about slightly less than 1 inch long. The strips are positioned between the upper layer of nonwoven material 126 and the strainable web material 60. The strips are held in place by adhesively bonding the strips to the uppermost nonwoven layer.
- 30 **[0171]** FIG. 38 shows a sanitary napkin having a panty covering component with edge stiffening members 150 of an alternative configuration. In the embodiment shown in FIG. 38, the edge stiffening members 150 comprise pieces of foam that resemble hair combs (or structures having an "E" shape). The stiffening members 150 have a plurality of transversely-oriented "teeth" 154 extending outward from a longitudinally-oriented member 156. The longitudinally-oriented member 156 can be between about 2 - 4 inches (about 5 - 10 cm) long. The teeth 154 provide resistance to edge compression. The longitudinally-oriented member 156 serves as a backbone that provides added bending resistance and stability to the teeth.
- 35 **[0172]** The garment surface 20B of the sanitary napkin 20 (e.g., the garment surface 100B of the panty covering component) may include fasteners (or "means for attaching the sanitary napkin to the undergarment of the wearer" or "attaching means") 44.
- 40 **[0173]** Figures 2 and 3 show the central pad fastener 44 which is adapted to secure the portion of the sanitary napkin underlying the main body portion 21 to the crotch region of an undergarment. Fasteners comprising adhesives have been found to work well for this purpose. Any adhesive or glue used in the art for such purposes can be used, with pressure-sensitive adhesives being preferred. Suitable adhesives are Century A-305-IV manufactured by the Century Adhesives Corporation, Instant Lock 34-2823 manufactured by the National Starch Company, 3 Sigma 3153 manufactured by 3 Sigma, and Fuller H-2238ZP manufactured by the H.B. Fuller Co. Suitable adhesive fasteners are also described in U.S. Patent 4,917,697.
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F. Fasteners for Attaching the Sanitary Napkin to the Wearer's Panties.

- 50 **[0172]** The garment surface 20B of the sanitary napkin 20 (e.g., the garment surface 100B of the panty covering component) may include fasteners (or "means for attaching the sanitary napkin to the undergarment of the wearer" or "attaching means") 44.
- 55 **[0173]** Figures 2 and 3 show the central pad fastener 44 which is adapted to secure the portion of the sanitary napkin underlying the main body portion 21 to the crotch region of an undergarment. Fasteners comprising adhesives have been found to work well for this purpose. Any adhesive or glue used in the art for such purposes can be used, with pressure-sensitive adhesives being preferred. Suitable adhesives are Century A-305-IV manufactured by the Century Adhesives Corporation, Instant Lock 34-2823 manufactured by the National Starch Company, 3 Sigma 3153 manufactured by 3 Sigma, and Fuller H-2238ZP manufactured by the H.B. Fuller Co. Suitable adhesive fasteners are also described in U.S. Patent 4,917,697.

[0174] The central pad fastener 44 can be in many possible configurations depending on the characteristics desired for the sanitary napkin. Figs. 2 and 3 show one preferred arrangement which utilizes a longitudinally oriented zone of extensible adhesive centered about the longitudinal centerline L. Other suitable fastener configurations are shown in PCT International Patent Publication No. WO 92/04000 entitled "Shape and Adhesive Fastening Means for an Absorbent Article" published in the name of Papa, et al. on March 19, 1992; PCT Publication No. WO 93/01783 published in the name of Olsen, et al., and in PCT Publication No. WO 93/01785 published in the name of Osborn, et al.

[0175] It should be understood that if it is desired to make the component that forms the garment surface of the sanitary napkin (and any overlying components) extensible in the wearer's panties, the particular adhesive configurations that can be used depend on whether extensible or inextensible adhesives are used. The portion of the sanitary napkin on which extensible adhesives are located will be extensible. Sanitary napkins containing inextensible adhesives will typically only be capable of extension between the inextensible adhesive patches. Therefore, if inextensible adhesives are used, they are preferably applied in intermittent patterns, including but not limited to intermittent dots, intermittent strips, and the like, to permit the sanitary napkin to extend between adhesive patches. If, on the other hand, the adhesive is extensible, the adhesive can be applied in continuous or intermittent patterns in the above configurations (and other configurations). If the adhesives are extensible, they preferably extend approximately the same amounts as the sanitary napkin as set forth in Table 1.

[0176] Suitable extensible adhesives include extensible adhesives, per se, and extensible adhesive/backsheet combinations. Any extensible adhesives known in the art can be used. Suitable extensible adhesive/backsheet combinations include, but are not limited to non-extensible adhesive used on an extensible backsheet material such as 3 Sigma 2474 available from Anchor Continental, Inc., 3 Sigma Division, of Covington, Ohio; elastically stretchable adhesive films such as Findley adhesive 198-338, or an elastically stretchable adhesive film known as 3M XPO-0-014 available from the Minnesota Mining and Manufacturing Company of St. Paul, Minnesota; or spray adhesives such as 3M adhesive 1442 on a low modulus elastic film.

[0177] In addition, other types of fasteners can be used instead of, or in addition to adhesives. These other types of fasteners are preferably arranged in patterns similar to those in the patent publications referred to above. Such fasteners include, but are not limited to conventional VELCRO hook material, the fasteners described in: U.S. Patent 4,946,527 issued to Battrell on August 7, 1990; U.S. Patents 5,058,247 and 5,116,563 issued to Thomas, et al. on October 22, 1991 and May 26, 1992, respectively; and EPO Patent Application Publication No. 0 381 087 published August 8, 1990; or, high coefficient of friction foams and other high coefficient of friction materials in the same category as those described in U.S. Patent 4,166,464 issued to Korpman, U.S. Patent 4,834,739 issued to Linker, III, et al., and U.S. Patent 5,011,480 issued to Gossens, et al. These fasteners may also be made extensible as described in PCT Publication No. 93/01785.

[0178] The side wrapping elements 52, as noted above, should wrap and stay without being provided with fasteners to secure the same to the panties. However, embodiments of the present invention may have optional fasteners thereon for additional security. The optional side wrapping element fasteners 45 can be any of the types of fastening materials specified herein.

[0179] The optional side wrapping element fasteners 45 assist the side wrapping elements 52 in staying in position after they are wrapped around the edges of the crotch portion of the panty. The side wrapping element fasteners 45 may be located on the garment surface of side wrapping elements 52, adjacent the distal edges 53 of the side wrapping elements 52 (i.e., the end of the side wrapping elements 52 farthest away from the longitudinal centerline L of the sanitary napkin 20), or at various other locations on the side wrapping elements.

[0180] In one alternative embodiment, as shown in Fig. 21, the side wrapping elements 52 are provided with side wrapping elements in the form of strips of hook material 45 or other mechanical fastener material 45. In this preferred embodiment, the hooks 49 on the strips of hook material 45 are distributed in a radial pattern. The hooks can be oriented in a particular direction for improved gripping properties. Preferably, in the embodiment in Fig. 21, the mouths of the hooks are oriented so that they face the intersection of the longitudinal and transverse centerlines.

[0181] The use of mechanical fasteners on absorbent articles is believed to be particularly beneficial, due to their tendency to reduce the effect of the shearing forces exerted on the garment surface 20B of the sanitary napkin 20 by the wearer's panties moving in response to the wearer's body motions. Mechanical fasteners that engage the fabric of the wearer's panties will move with the panties, reducing the problems caused by these shearing forces. The mechanical fastening devices have engaging elements 49 that preferably engage the fabric (typically, the yarns of a knit or woven fabric) covering the panty leg elastics. The mechanical fastening devices may engage the fabric covering the top of the wearer's panty elastics, the fabric covering the sides of the panty elastics, or the fabric covering the bottom of the panty elastics.

[0182] The use of mechanical attachment elements at or near the panty elastics and at other places, such as at the end edges 24 of the main body portion of the sanitary napkin 20, also eliminates several problems associated with the use of adhesive fasteners alone. Mechanical fasteners are not subject to the problem of adhesives sticking to the wearer's body hair. They are also not subject to the problem of the adhesives become unattached and causing the san-

itary napkin folding back and stick to itself when the panty and panty elastics move and stretch. Further, as shown in Figure 22, the leg elastics of the wearer's panties, E, are stretched when the panties are put on by the wearer. This causes the elastics to exert forces F_E against the wearer's body. These forces provide a normal force component relative to the portions of the side wrapping elements 52 that are against the wearer's body. The normal force component can be used to cause mechanical or frictional attachment means to be more effective. Normal forces may aid mechanical fasteners having hook-like elements in penetrating and hooking onto the fabric of the wearer's panties. Ideally, the normal forces will cause the hooks to automatically engage the panty fabric with little or no effort needed on the part of the wearer to press the hooks into the panties.

[0183] In another alternative embodiment shown in Fig. 23, the panty covering component 100 has indentations at its four corners 120 to allow the panty covering component to adjust to the shape of the wearer's undergarments. This embodiment is especially useful when the sanitary napkin is worn with menstrual shorts of the type typically worn by Japanese women. The indentations also allow the panty covering component to assist the side wrapping elements in flipping underneath the crotch region of the wearer's undergarments. The panty covering component 100 shown in Fig. 23 is preferably provided with an overall multi-directional extensibility. The panty covering component is also preferably provided with an adhesive fastener that covers the entire garment side of the same with the exception of two longitudinally oriented zones 128 which are adhesive-free. The adhesive-free zones 128 prevent the side wrapping elements 52 from folding over onto and sticking to other portions of the panty covering component after the release paper is removed from the back of the panty covering component. Optionally, the adhesive-free areas can be provided with a releasable material to further reduce any tendency for the side wrapping elements to stick to these portions of the panty covering component.

[0184] Before the sanitary napkin 20 is placed in use, if an adhesive fastener is used, the adhesive is typically covered with a removable cover strip or release liner in order to keep the adhesive from sticking to a surface other than the crotch portion of the panty prior to use. Suitable release liners are also described in the above-referenced U.S. Patent 4,917,697. Any commercially available release liners commonly used for such purposes can be utilized herein. Non-limiting examples of suitable release liners are BL30MG-A Silox E1/0 and BL30MG-A Silox 4P/0, both of which are manufactured by the Akrosil Corporation.

[0185] In particularly preferred embodiments, the adhesive fastener 44 is protected with a wrapper that not only covers the adhesive, but also provides both an individually packaged sanitary napkin and a container for disposing the sanitary napkin after use, such as is described in U.S. Patent 4,556,146 issued to Swanson, et al. on December 3, 1985 and in PCT International Publication No. WO 93/09743 entitled "Sanitary Napkin Wrapper and Adhesive Tab Construction for the Same" published in the name of Berg, et al. on May 27, 1993.

[0186] The sanitary napkin 20 of the present invention is used by removing any release liner and thereafter placing the sanitary napkin 20 in a panty so that the adhesive (or other fastener) 44 contacts the panty and maintains the sanitary napkin in position within the panty during use.

[0187] The following Example further illustrates the practice of the present invention. The following Example, however, is not intended to limit the scope of the absorbent articles encompassed herein.

EXAMPLE

[0188] The topsheet 38 is made in accordance with U.S. Patent 4,463,045 and ring rolled to provide it with longitudinal extensibility. The absorbent core 42 is a superabsorbent material laminate as described above which is slit at the end regions 28 and 30 for longitudinal extensibility, but not at the central region 32. The backsheets 40 are an extensible adhesive film known as Formula #198-338 manufactured by the Findley Adhesives Company of Wauwatosa, Wisconsin.

[0189] The sanitary napkin 20 also includes a creped BOUNTY (TM) paper towel layer and several layers of extensible nonwoven material obtained from Veratec Inc., a Division of International Paper Company, of Walpole, Massachusetts. One nonwoven layer comprises spunlaced nonwoven having a basis weight of 19 g/yd². Two webs of Veratec P-8 carded polypropylene extensible nonwoven material and a web of strainable web material formed by embossing plates having dimensions described above are also used.

[0190] Assembly of the main body portion of the sanitary napkin is as follows. Cut the ring-rolled topsheet to size. Place a template on the bottom side of the topsheet and apply Findley 4031 adhesive in a spiral pattern. Lay the Findley backsheets with a protective release paper attached on flat surface. Place the slitted absorbent gelling material (AGM) laminate core on the Findley backsheets. Center the creped BOUNTY tissue (shaped similarly to the topsheet) over the laminate core. Place the topsheet over the creped tissue. Secure the components and smooth at edges. Roll the edges to seal. Peel the release paper from the back of the backsheets. Tear and remove in 2 or 3 pieces, then place the spunlaced Veratec nonwoven material on the exposed adhesive on the backsheets (oriented so the nonwoven is extensible in the longitudinal direction). Spray the topsheet with 0.01 g. PEGOSPERSE surfactant available from Lonza, Inc., Williamsport, PA.

[0191] Assembly of the panty covering component is as follows. Cut a first web of the 19.6 grams/square yard basis

weight nonwoven material (P-8 material) to be used for the lowermost nonwoven layer to size. Apply Findley adhesive 2031 in a spiral pattern across the entire surface. Lay a sheet of strainable web material cut to the same size (with either face of the same facing upward) on top of the first web of nonwoven material. Apply a one inch (2.5 cm) wide strip of Findley adhesive 2031 in a spiral pattern along each longitudinal side margin of the strainable web material. Take another web of P-8 material cut to the same size as the first, and cut this second web of P-8 material in half along its longitudinal axis. Place the two pieces of P-8 material on top of the strainable web material so that they abut at the longitudinal axis of the strainable web material. Fold the inner edges of the upper layers of P-8 material back on the remaining portions of the layers so that the inner edges are about 25 mm from the distal edges of the underlying layer of P-8 and strainable web material to form pleats that will serve as isolation elements. Apply a 1/4 inch strip of adhesive to each folded back portion of the upper layers along the longitudinal edges of the same. Apply two 60 mm long, 1/4 inch wide strips of adhesive transversely across the garment-facing side of the main body portion so that they are spaced the same distance from the transverse centerline and 140 mm apart. Bond the panty covering component assembly thus formed to the garment-facing side of the main body portion. Apply panty fastening adhesive to the garment-facing side of the panty covering component.

[0192] The specifications of the finished product are as follows:

Main Body Portion	
Parameters of Main Body Portion	Specifications
Pad weight (g)	8.50 ± 0.18
Core weight (g) laminate	2.54 ± 0.09
Pad length (mm)	232 ± 4
Core length (mm) laminate	201 ± 1
Pad width at center (mm)	85 ± 1
Core width at center (mm)	65 ± 1
Pad caliper (in. at 0.13 psi)	0.11 ± 0.01 (2.9 mm)
Core caliper (in. at 0.13 psi)	0.074 ± 0.003
Components of Main Body Portion	Specifications
Polyethylene formed-film topsheet (per U.S. Patent 4,463,045; ring rolled)	9" x 5"
Findley extensible adhesive film backsheet (Formula #198-338)	-9" x 5"
Creped BOUNTY paper towel	Shaped*
PFA (panty fastening adhesive)	None
PEGOSPERSE	0.01 g
Veratec spunlaced nonwoven (19 g/yd ²)	9" x 5"
AGM slit core non-slit center; total	65 mm x 193 mm
core weight 2.5 g; contains 0.7 g AGM	with 2 3/4" non-slit center
Findley 4031 (adhesive)	0.05 g

Isolation Layer/Panty Covering Component	
Parameters	Specifications
Overall length (mm)	140 ± 5
Overall width (mm)	108 ± 2
Width of pleat (mm)	18 ± 5
Components	Specifications
Veratec P-8 nonwoven (19.6 g/yd ² - 2 layers)	7" x 5"
Strainable web material (Size of deformations as described previously in specification)	7" x 5"
Findley adhesive (as described in description of assembly)	
Bond to main body portion (1/4" strip arranged in a rectangular configuration)	400 mm x 0.25"
PFA (panty fastening adhesive)(mm)	188 x 61
Release paper	As needed

G. Other Alternative Embodiments.

- [0193] While several preferred sanitary napkin embodiments have been described, numerous other sanitary napkin embodiments are disclosed in the literature. These could be provided with the panty covering component of the present invention. Some of such sanitary napkins are described in U.S. Patents 5,009,653 and 4,950,264, issued to Osborn on April 23, 1991 and August 21, 1990, respectively, and in PCT Publication No. WO 93/01781, entitled "Curved, Shaped Absorbent Article" filed in the name of Johnson, et al.
- [0194] The terms "panty liner" or "pantiliner" refer to absorbent articles that are less bulky than sanitary napkins which are generally worn by women between their menstrual periods. Suitable absorbent articles in the form of pantliners are disclosed in U.S. Patent 4,738,676 entitled "Pantiliner" issued to Osborn on April 19, 1988.
- [0195] The term "incontinence article" refers to pads, undergarments (pads held in place by a suspension system of same type, such as a belt, or the like), inserts for absorbent articles, capacity boosters for absorbent articles, briefs, bed pads, and the like, regardless of whether they are worn by adults or other incontinent persons. Suitable incontinent articles that can be provided with the panty covering components described herein are disclosed in U.S. Patent 4,253,461 issued to Strickland, et al. on March 3, 1981; U.S. Patents 4,597,760 and 4,597,761 issued to Buell; the above-mentioned U.S. Patent 4,704,115; U.S. Patent 4,909,802 issued to Ahr, et al.; U.S. Patent 4,964,860 issued to Gipson, et al. on October 23, 1990; and in PCT Publication Nos. WO 92/11830 and WO 92/11831.

Claims

1. An absorbent article (20) having a longitudinal dimension extending in a longitudinal direction and a transverse dimension extending in a transverse direction, a longitudinal centerline (L), and a transverse centerline (T), said absorbent article (20) comprising:
 - a main body portion (21) comprising an absorbent core (42), said main body portion (21) having a body-facing side (21A), a garment-facing side (21B), and a pair of longitudinal side edges (22);
 - an undergarment covering component (100), said undergarment covering component (100) comprising a pair of side wrapping element (52) that extend laterally outward beyond the longitudinal side edges of said main body portion (21) a distance of less than one-half the width of said main body portion (21) to distal edges, wherein at least a portion of said undergarment covering component (100) is extensible generally in the longitudinal direction and said undergarment covering component (100) comprises a web material (60) having a strainable network of distinct regions which exhibits at least two-stages of controlled resistive forces to an applied axial elongation along at least one predetermined axis when subjected to applied axial elongation in a direction parallel to said predetermined axis, characterised in that said distinct regions comprising at least a first region (64) and a second region (66), said first region (64) having a surface-pathlength that is less than

that of said second region (66) when measured parallel to said predetermined axis while said web material is in an untensioned condition.

- 5 2. The absorbent article (20) of Claim 1 wherein said extensible portion of said undergarment covering component (100) is also extensible in the transverse direction.
- 10 3. The absorbent article (20) of Claim 1 wherein said web material (60) has a longitudinal axis aligned with the longitudinal centerline of the absorbent article (20) and said network of said web material (60) comprises a formed portion of a base material, and said first region (64) of said network comprises a plurality of substantially planar, linear regions that are aligned with the longitudinal axis of said web material (60) and said second regions (66) comprises a plurality of deformations (74) which are oriented substantially perpendicular to said longitudinal axis of said web material (60).
- 15 4. The absorbent article (20) of Claim 1 wherein said web material (60) having a strainable network comprises a base material selected from the group consisting of films, foams, nonwoven webs, apertured webs, macroscopically expanded three-dimensional apertured webs, absorbent webs, and fibrous webs.
- 20 5. The absorbent article (20) of Claim 4 wherein said base material comprises a polymeric material selected from the group consisting of polyethylene, low density polyethylene, linear low density polyethylene, ultra low density polyethylene, high density polyethylene, and blends thereof.
- 25 6. The absorbent article (20) of Claim 1 wherein said web material (60) having a strainable network is a part of a laminate of two or more layers.
- 30 7. The absorbent article (20) of Claim 6 wherein said laminate is comprised of layers selected from the group consisting of films, foams, nonwovens, apertured webs, macroscopically expanded three-dimensional webs, absorbent webs, and fibrous webs.
- 35 8. The absorbent article (20) of Claim 7 wherein said undergarment covering component (100) comprises a laminate of said web material (60) having a strainable network positioned between two extensible nonwoven layers.
9. The absorbent article (20) of Claim 7 wherein said web material (60) having a strainable network has a pair of longitudinal edges and said undergarment covering component (100) comprises a laminate of said web material (60) wherein a nonwoven web wraps around each longitudinal edge of said web material (60).
- 40 10. The absorbent article (20) of Claims 1 or 2 wherein said extensible portion of said undergarment covering component (100) is extensible in amounts greater than or equal to about 5% and less than about 50% under forces of between about 50 grams and about 1,500 grams.
- 45 11. The absorbent article (20) of Claim 10 wherein said extensible portion of said undergarment covering component (100) is extensible between about 10% and 40% under such forces.
12. The absorbent article (20) of Claim 1 wherein said extensible portion of said undergarment covering component (100) has a return force of less than or equal to about 100 grams.
- 50 13. The absorbent article (20) of Claim 1 wherein said extensible portion has a percent set of greater than or equal to about 10% strain.
14. The absorbent article (20) of Claim 1 wherein said side wrapping elements (52) each have a distal edge (53) and a resistance to edge compression of greater than or equal to about 5 grams.
- 55 15. The absorbent article (20) of Claim 1 wherein said side wrapping elements (52) have a fold retention of less than or equal to about 100°.
16. The absorbent article (20) of Claim 1 wherein said distal edges (53) of said side wrapping elements (52) are in a non-overlapping configuration when said absorbent article is worn.
17. The absorbent article (20) of Claim 16 wherein said distal edges (53) extend outward beyond the inwardmost point

on the longitudinal side edges (22) of said main body portion (21) a distance of less than or equal to about 3 cm.

18. The absorbent article (20) of Claim 1 wherein said undergarment covering component (100) as a span from distal edge (53) to distal edge (53) of said side wrapping element (52) of less than or equal to about 12 cm.
19. The absorbent article (20) of Claim 1 wherein said undergarment covering component (100) is liquid impervious.
20. The absorbent article (20) of Claim 1 wherein said main body portion (21) further comprises a liquid impervious backsheet (40) joined to said absorbent core (42), said backsheet (40) having a body-facing side that faces said absorbent core (42) and a garment-facing side, and said undergarment covering component (100) comprises a separate component that is joined to the garment-facing side of said backsheet (40).
21. The absorbent article (20) of Claim 1 wherein said side wrapping elements (52) of said undergarment covering component (100) comprise a single component.
22. The absorbent article (20) of Claim 1 wherein said side wrapping elements (52) of said undergarment covering component (100) comprise two or more separate components.
23. The absorbent article (20) of Claim 1 wherein said entire undergarment covering component (100) is extensible.
24. The absorbent article (20) of Claim 1 wherein said main body portion (21) is inextensible.
25. The absorbent article (20) of Claim 1 wherein said main body portion (21) is extensible.
26. The absorbent article (20) of Claim 1 wherein said panty covering component (100) further comprises at least one edge stiffening member (150) joined adjacent to the distal edges (53) of at least one of said side wrapping elements (52), said edge stiffening member (150) comprising a component that reinforces said side wrapping elements (52) against lateral compressive forces, said edge stiffening member (150) being flexible and being joined to said side wrapping element (52) so that said side wrapping element (52) is extensible.
27. The absorbent article (20) of Claim 26 wherein said edge stiffening member (150) is an integral part of said side wrapping element (52).
28. The absorbent article (20) of Claim 26 wherein said edge stiffening member (150) comprises a separate element which is joined to said side wrapping element (52).
29. The absorbent article (20) of Claim 26 wherein said edge stiffening member (150) comprises an elongated member.
30. The absorbent article (20) of Claim 26 wherein said edge stiffening member (150) is oriented in the transverse direction.
31. The absorbent article (20) of Claim 26 wherein said edge stiffening member (150) is oriented in the longitudinal direction.
32. The absorbent article (20) of Claim 26 comprising a plurality of edge stiffening members (150).
33. The absorbent article (20) of Claim 32 wherein at least some of said plurality of edge stiffening members (150) are arranged in the configuration of a letter "E".
34. The absorbent article (20) of Claim 26 wherein said edge stiffening member (150) comprises a foam piece.

Patentansprüche

1. Absorbierender Artikel (20) mit einer Längsdimension, welche sich in einer Längsrichtung erstreckt, und einer Querdimension, welche sich in einer Querrichtung erstreckt, einer Längsmittellinie (L), einer Quermittellinie (T), wobei der genannte absorbierende Artikel (20) umfaßt:

einen Hauptkörperabschnitt (21), welcher einen absorbierenden Kern (42) umfaßt; wobei der genannte Hauptkörperabschnitt (21) eine dem Körper zugewandte Seite (21A), eine der Kleidung zugewandte Seite (21B) und ein Paar Längsseitenränder (22) aufweist;

5 einen Unterwäsche bedeckenden Bestandteil (100), wobei der genannte Unterwäsche bedeckende Bestandteil (100) ein Paar seitenumhüllende Elemente (52) umfaßt, welche sich über die Längsseitenränder des genannten Hauptkörperabschnittes (21) hinaus seitlich auswärts in einer Distanz von weniger als einer Hälfte der Breite des genannten Hauptkörperabschnittes (21) zu distalen Rändern erstrecken, wobei mindestens ein Abschnitt des genannten Unterwäsche bedeckenden Bestandteiles (100) allgemein in der Längsrichtung ver-
10 längerbar ist und der genannte Unterwäsche bedeckende Bestandteil (100) ein Bahnenmaterial (60) aufweist, welches ein dehnbares Netzwerk verschiedenartiger Bereiche aufweist, welches mindestens zwei Stufen kontrollierter Widerstandskräfte gegen eine aufgebrachte Axialverlängerung entlang mindestens einer vorher festgelegten Achse aufweist, wenn es in einer Richtung parallel zur genannten vorher festgelegten Achse aufgebrachter Axialverlängerung unterworfen ist, dadurch gekennzeichnet, daß die genannten verschiedenartigen Bereiche mindestens einen ersten Bereich (64) und einen zweiten Bereich (66) umfassen, wobei der
15 genannte erste Bereich (64) eine Oberflächenweglänge, gemessen parallel zur genannten vorher festgelegten Achse, aufweist, welche geringer ist als jene des genannten zweiten Bereiches (66), während das genannte Bahnenmaterial sich in einem angespannten Zustand befindet.

2. Der absorbierende Artikel (20) nach Anspruch 1, bei welchem der genannte verlängerbare Abschnitt des genannten Unterwäsche bedeckenden Bestandteiles (100) ebenso in der Querrichtung verlängerbar ist.
20
3. Der absorbierende Artikel (20) nach Anspruch 1, bei welchem das genannte Bahnenmaterial (60) eine Längsachse aufweist, welche mit der Längsmittellinie des absorbierenden Artikels (20) axial ausgerichtet ist, und das genannte Netzwerk des genannten Bahnenmaterials (60) einen aus einem Ausgangsmaterial geformten Abschnitt umfaßt
25 und der genannte erste Bereich (64) des genannten Netzwerkes eine Mehrzahl von im wesentlichen planen linearen Bereichen aufweist, welche mit der Längsachse des genannten Bahnenmaterials (60) axial ausgerichtet sind, und die genannten zweiten Bereiche (66) eine Mehrzahl von Verformungen (74) aufweisen, welche im wesentlichen lotrecht zur genannten Längsachse des genannten Bahnenmaterials (60) ausgerichtet sind.
- 30 4. Der absorbierende Artikel (20) nach Anspruch 1, bei welchem das genannte Bahnenmaterial (60) ein dehnbares Netzwerk aufweist, welches ein Ausgangsmaterial umfaßt, welches aus der Gruppe bestehend aus Folien, Schaumstoffen, Faservliesbahnen, mit Öffnungen versehenen Bahnen, makroskopisch expandierten, dreidimensionalen mit Öffnungen versehenen Bahnen, absorbierenden Bahnen und faserigen Bahnen ausgewählt ist.
- 35 5. Der absorbierenden Artikel (20) nach Anspruch 4, bei welchem das genannte Ausgangsmaterial eine polymeres Material umfaßt, welches aus der Gruppe bestehend aus Polyethylen, Polyethylen niedriger Dichte, linearem Polyethylen niedriger Dichte, Polyethylen ultraniedriger Dichte, Polyethylen hoher Dichte und Mischungen derselben ausgewählt ist.
- 40 6. Der absorbierende Artikel (20) nach Anspruch 1, bei welchem das genannte Bahnenmaterial (60), welches ein dehnbares Netzwerk aufweist, ein Teil eines Laminates aus zwei oder mehr Schichten ist.
7. Der absorbierende Artikel (20) nach Anspruch 6, bei welchem das genannte Laminat aus zwei Schichten besteht, welche aus der Gruppe bestehend aus Folien, Schaumstoffen, Faservliesen, mit Öffnungen versehenen Bahnen,
45 makroskopisch expandierten dreidimensionalen Bahnen, absorbierenden Bahnen und faserigen Bahnen ausgewählt ist.
8. Der absorbierende Artikel (20) nach Anspruch 7, bei welchem der genannte Unterwäsche bedeckende Bestandteil (100) ein Laminat des genannten Bahnenmaterials (60) umfaßt, welches ein dehnbares Netzwerk aufweist, welches zwischen zwei verlängerbaren Faservliesschichten positioniert ist.
50
9. Der absorbierende Artikel (20) nach Anspruch 7, bei welchem das genannte Bahnenmaterial (60), welches ein dehnbares Netzwerk aufweist, ein Paar Längsränder umfaßt und der genannte Unterwäsche bedeckende Bestandteil (100) ein Laminat aus dem genannten Bahnenmaterial (60) aufweist, bei welchem eine Faservliesbahn
55 sich rund um jeden Längsrand des genannten Bahnenmaterials (60) legt.
10. Der absorbierende Artikel (20) nach Anspruch 1 oder 2, bei welchem der genannte verlängerbare Abschnitt des genannten Unterwäsche bedeckenden Bestandteiles (100) unter Kräften zwischen etwa 50 g und etwa 1.500 g in

Ausmaßen verlängerbar ist, welche größer als oder gleich etwa 5 % oder weniger als etwa 50 % sind.

11. Der absorbierende Artikel (20) nach Anspruch 10, bei welchem der genannte verlängerbare Abschnitt des genannten Unterwäsche bedeckenden Bestandteiles (100) unter derartigen Kräften zwischen etwa 10 % und 40 % verlängerbar ist.
12. Der absorbierende Artikel (20) nach Anspruch 1, bei welchem der genannte verlängerbare Abschnitt des genannten Unterwäsche bedeckenden Bestandteiles (100) eine Rückstellkraft von weniger als oder gleich etwa 100 g aufweist.
13. Der absorbierende Artikel (20) nach Anspruch 1, bei welchem der genannte verlängerbare Abschnitt einen Prozentsatz von mehr als oder gleich etwa 10 % Dehnung aufweist.
14. Der absorbierende Artikel (20) nach Anspruch 1, bei welchem die genannten seitenumhüllenden Elemente (52) jeweils einen distalen Rand (53) und einen Widerstand gegen Randkompression von mehr als oder gleich etwa 5 g aufweisen.
15. Der absorbierende Artikel (20) nach Anspruch 1, bei welchem die genannten seitenumhüllenden Elemente (52) einen Faltenrückhalt von weniger als oder gleich etwa 100° aufweisen.
16. Der absorbierende Artikel (20) nach Anspruch 1, bei welchem die genannten distalen Ränder (53) der genannten seitenumhüllenden Elemente (52) sich in einer nicht überlappenden Konfiguration befinden, wenn der genannte absorbierende Artikel getragen wird.
17. Der absorbierende Artikel (20) nach Anspruch 16, bei welchem die genannten distalen Ränder (53) sich über den innersten Punkt an den Längsseitenrändern (22) des genannten Hauptkörperabschnittes (21) hinaus über eine Distanz von weniger als oder gleich etwa 3 cm auswärts erstrecken.
18. Der absorbierende Artikel (20) nach Anspruch 1, bei welchem der genannte Unterwäsche bedeckende Bestandteil (100) eine Spanne vom distalen Rand (53) zum distalen Rand (53) des genannten seitenumhüllenden Elements (52) von weniger als oder gleich etwa 12 cm aufweist.
19. Der absorbierende Artikel (20) nach Anspruch 1, bei welchem der genannte Unterwäsche bedeckende Bestandteil (100) flüssigkeitsundurchlässig ist.
20. Der absorbierende Artikel (20) nach Anspruch 1, bei welchem der genannte Hauptkörperabschnitt (21) weiters ein flüssigkeitsundurchlässiges Rückenblatt (40) aufweist, welches mit dem genannten absorbierenden Kern (42) verbunden ist, wobei das genannte Rückenblatt (40) eine dem Körper zugewandte Seite, welche dem genannten absorbierenden Kern (42) zugewandt ist, und eine der Kleidung zugewandte Seite umfaßt, und der genannte Unterwäsche bedeckende Bestandteil (100) einen gesonderten Bestandteil umfaßt, welcher mit der der Kleidung zugewandten Seite des genannten Rückenblattes (40) verbunden ist.
21. Der absorbierende Artikel (20) nach Anspruch 1, bei welchem die genannten seitenumhüllenden Elemente (52) des genannten Unterwäsche bedeckenden Bestandteiles (100) einen einzigen Bestandteil umfassen.
22. Der absorbierende Artikel (20) nach Anspruch 1, bei welchem die genannten seitenumhüllenden Elemente (52) des genannten Unterwäsche bedeckenden Bestandteiles (100) zwei oder mehr gesonderte Bestandteile aufweisen.
23. Der absorbierende Artikel (20) nach Anspruch 1, bei welchem der genannte gesamte Unterwäsche bedeckende Bestandteil (100) verlängerbar ist.
24. Der absorbierende Artikel (20) nach Anspruch 1, bei welchem der genannte Hauptkörperabschnitt (21) unverlängerbar ist.
25. Der absorbierende Artikel (20) nach Anspruch 1, bei welchem der genannte Hauptkörperabschnitt (21) verlängerbar ist.

26. Der absorbierende Artikel (20) nach Anspruch 1, bei welchem der genannte hörschenbedeckende Bestandteil (100) weiters mindestens einen randversteifenden Bauteil (150) umfaßt, welcher anliegend an die distalen Ränder (53) mindestens eines der genannten seitenumhüllenden Elemente (52) verbunden ist, wobei der genannte randversteifende Bauteil (150) einen Bestandteil umfaßt, welcher die genannten seitenumhüllenden Elemente (52) gegen seitliche kompressive Kräfte verstärkt, wobei der genannte randversteifende Bauteil (150) flexibel ist und mit dem genannten seitenumhüllenden Element (52) derart verbunden ist, daß das genannte seitenumhüllende Element (52) verlängerbar ist.
27. Der absorbierende Artikel (20) nach Anspruch 26, bei welchem der genannte randversteifende Bauteil (150) ein integraler Teil des genannten seitenumhüllenden Elementes (52) ist.
28. Der absorbierende Artikel (20) nach Anspruch (26), bei welchem der genannte randversteifende Bauteil (150) ein gesondertes Element umfaßt, welches mit dem genannten seitenumhüllenden Element (52) verbunden ist.
29. Der absorbierende Artikel (20) nach Anspruch 26, bei welchem der genannte randversteifende Bauteil (150) einen länglichen Bauteil umfaßt.
30. Der absorbierende Artikel (20) nach Anspruch 26, bei welchem der genannte randversteifende Bauteil (150) in der Querrichtung ausgerichtet ist.
31. Der absorbierende Artikel (20) nach Anspruch 26, bei welchem der genannte randversteifende Bauteil (150) in der Längsrichtung ausgerichtet ist.
32. Der absorbierende Artikel (20) nach Anspruch 26, welcher eine Mehrzahl von randversteifenden Bauteilen (150) umfaßt.
33. Der absorbierende Artikel (20) nach Anspruch 32, bei welchem mindestens einige der genannten Mehrzahl von randversteifenden Bauteilen (150) in der Konfiguration eines Buchstaben „E“ angeordnet sind.
34. Der absorbierende Artikel (20) nach Anspruch 26, bei welchem der genannte randversteifende Bauteil (150) ein Schaumstoffstück umfaßt.

Revendications

1. Article absorbant (20) ayant une dimension longitudinale qui s'étend dans une direction longitudinale et une dimension transversale qui s'étend dans une direction transversale, une ligne médiane longitudinale (L) et une ligne médiane transversale (T), ledit article absorbant (20) comprenant :
- une partie de corps principale (21) comprenant une âme absorbante (42), ladite partie de corps principale (21) ayant une face côté corps (21A), une face côté vêtement (21B) et une paire de bords latéraux longitudinaux (22) ;
- un composant de couverture de sous-vêtement (100), ledit composant de couverture de sous-vêtement (100) comprenant une paire d'éléments d'enveloppement latéraux (52) qui s'étendent vers l'extérieur dans la direction latérale, au-delà des bords latéraux longitudinaux de ladite partie de corps principale (21), sur une distance inférieure à la moitié de la largeur de ladite partie de corps principale (21), jusqu'aux bords distaux, au moins une partie dudit composant de couverture de sous-vêtement (100) étant généralement extensible dans la direction longitudinale et ledit composant de couverture de sous-vêtement (100) comprenant une nappe (60) ayant un réseau déformable de régions distinctes qui présente au moins deux étapes de forces de résistance régulées à un allongement axial appliqué le long d'au moins un axe prédéterminé, lorsqu'il est soumis à un allongement axial appliqué dans une direction parallèle audit axe prédéterminé, caractérisé en ce que lesdites régions distinctes comprennent au moins une première région (64) et une deuxième région (66), ladite première région (64) ayant une longueur de trajet de surface inférieure à celle de ladite deuxième région (66), lorsqu'on la mesure dans une direction parallèle audit axe prédéterminé alors que ladite nappe est dans un état non tendu.
2. Article absorbant (20) selon la revendication 1, dans lequel ladite partie extensible dudit composant de couverture de sous-vêtement (100) est également extensible dans la direction transversale.

3. Article absorbant (20) selon la revendication 1, dans lequel ladite nappe (60) a un axe longitudinal aligné avec la ligne médiane longitudinale de l'article absorbant (20) et ledit réseau de ladite nappe (60) comprend une partie formée, constituée d'un matériau de base, et ladite première région (64) dudit réseau comprend une pluralité de régions linéaires, essentiellement planes, qui sont alignées avec l'axe longitudinal de ladite nappe (60), et ladite deuxième région (66) comprend une pluralité de déformations (74) qui sont orientées essentiellement perpendiculairement audit axe longitudinal de ladite nappe (60).
5
4. Article absorbant (20) selon la revendication 1, dans lequel ladite nappe (60) ayant un réseau déformable comprend un matériau de base choisi dans le groupe comprenant des films, des mousses, des nappes non tissées, des nappes perforées, des nappes perforées tridimensionnelles, étendues de manière macroscopique, des nappes absorbantes, et des nappes fibreuses.
10
5. Article absorbant (20) selon la revendication 4, dans lequel ledit matériau de base comprend un matériau polymère choisi dans le groupe comprenant le polyéthylène, le polyéthylène basse densité, le polyéthylène basse densité linéaire, le polyéthylène très basse densité, le polyéthylène haute densité, et des mélanges de ceux-ci.
15
6. Article absorbant (20) selon la revendication 1, dans lequel ladite nappe (60) ayant un réseau déformable est une partie d'un stratifié constitué de deux couches ou plus.
7. Article absorbant (20) selon la revendication 6, dans lequel ledit stratifié est constitué de couches choisies dans le groupe comprenant des films, des mousses, des non tissés, des nappes perforées, des nappes tridimensionnelles, étendues de manière macroscopique, des nappes absorbantes, et des nappes fibreuses.
20
8. Article absorbant (20) selon la revendication 7, dans lequel ledit composant de couverture de sous-vêtement (100) comprend un stratifié constitué de ladite nappe (60) ayant un réseau déformable, positionnée entre deux couches de non tissé extensibles.
25
9. Article absorbant (20) selon la revendication 7, dans lequel ladite nappe (60) ayant un réseau déformable a une paire de bords longitudinaux, et ledit composant de couverture de sous-vêtement (100) comprend un stratifié constitué de ladite nappe (60), dans lequel une nappe non tissée est enveloppée autour de chaque bord longitudinal de ladite nappe (60).
30
10. Article absorbant (20) selon la revendication 1 ou 2, dans lequel ladite partie extensible dudit composant de couverture de sous-vêtement (100) est extensible selon une quantité supérieure ou égale à environ 5 % et inférieure à environ 50 %, sous l'effet de forces comprises entre environ 50 grammes et environ 1500 grammes.
35
11. Article absorbant (20) selon la revendication 10, dans lequel ladite partie extensible dudit composant de couverture de sous-vêtement (100) est extensible selon une quantité comprise entre environ 10 % et 40 %, sous l'effet de ces forces.
40
12. Article absorbant (20) selon la revendication 1, dans lequel ladite partie extensible dudit composant de couverture de sous-vêtement (100) a une force de retour inférieure ou égale à environ 100 grammes.
13. Article absorbant (20) selon la revendication 1, dans lequel ladite partie extensible a un allongement rémanent supérieur ou égal à environ 10 % de déformation.
45
14. Article absorbant (20) selon la revendication 1, dans lequel lesdits éléments d'enveloppement latéraux (52) ont chacun un bord distal (53) et une résistance à la compression des bords supérieure ou égale à environ 5 grammes.
15. Article absorbant (20) selon la revendication 1, dans lequel lesdits éléments d'enveloppement latéraux (52) ont une capacité de maintien du pliage inférieure ou égale à environ 100°.
50
16. Article absorbant (20) selon la revendication 1, dans lequel lesdits bords distaux (53) desdits éléments d'enveloppement latéraux (52) sont disposés suivant une configuration de non chevauchement lorsque ledit article absorbant est porté.
55
17. Article absorbant (20) selon la revendication 16, dans lequel lesdits bords distaux (53) s'étendent vers l'extérieur, au-delà du point le plus à l'intérieur situé sur les bords latéraux longitudinaux (22) de ladite partie de corps princi-

pale (21), sur une distance inférieure ou égale à environ 3 cm.

- 5 18. Article absorbant (20) selon la revendication 1, dans lequel ledit composant de couverture de sous-vêtement (100) a une portée entre le bord distal (53) et le bord distal (53) dudit élément d'enveloppement latéral (52) inférieure ou égale à environ 12 cm.
19. Article absorbant (20) selon la revendication 1, dans lequel ledit composant de couverture de sous-vêtement (100) est imperméable aux liquides.
- 10 20. Article absorbant (20) selon la revendication 1, dans lequel ladite partie de corps principale (21) comprend, en outre, une feuille de fond imperméable aux liquides (40) réunie à ladite âme absorbante (42), ladite feuille de fond (40) ayant une face côté corps qui se trouve en regard de ladite âme absorbante (42) et une face côté vêtement, et ledit composant de couverture de sous-vêtement (100) comprend un composant séparé qui est réuni à la face
15 côté vêtement de ladite feuille de fond (40).
21. Article absorbant (20) selon la revendication 1, dans lequel lesdits éléments d'enveloppement latéraux (52) dudit composant de couverture de sous-vêtement (100) comprennent un seul composant.
22. Article absorbant (20) selon la revendication 1, dans lequel lesdits éléments d'enveloppement latéraux (52) dudit
20 composant de couverture de sous-vêtement (100) comprennent deux composants séparés ou plus.
23. Article absorbant (20) selon la revendication 1, dans lequel la totalité dudit composant de couverture de sous-vêtement (100) est extensible.
- 25 24. Article absorbant (20) selon la revendication 1, dans lequel ladite partie de corps principale (21) n'est pas extensible.
25. Article absorbant (20) selon la revendication 1, dans lequel ladite partie de corps principale (21) est extensible.
- 30 26. Article absorbant (20) selon la revendication 1, dans lequel ledit composant de couverture de culotte (100) comprend, en outre, au moins un élément de renforcement de bord (150) réuni au voisinage des bords distaux (53) d'au moins l'un desdits éléments d'enveloppement latéraux (52), ledit élément de renforcement de bord (150) comprenant un composant qui renforce lesdits éléments d'enveloppement latéraux (52) vis-à-vis de forces de compression
35 latérales, ledit élément de renforcement de bord (150) étant flexible et étant réuni audit élément d'enveloppement latéral (52) de telle sorte que ledit élément d'enveloppement latéral (52) soit extensible.
27. Article absorbant (20) selon la revendication 26, dans lequel ledit élément de renforcement de bord (150) fait partie intégrante dudit élément d'enveloppement latéral (52).
- 40 28. Article absorbant (20) selon la revendication 26, dans lequel ledit élément de renforcement de bord (150) comprend un élément séparé qui est réuni audit élément d'enveloppement latéral (52).
29. Article absorbant (20) selon la revendication 26, dans lequel ledit élément de renforcement de bord (150) comprend un élément allongé.
- 45 30. Article absorbant (20) selon la revendication 26, dans lequel ledit élément de renforcement de bord (150) est orienté dans la direction transversale.
31. Article absorbant (20) selon la revendication 26, dans lequel ledit élément de renforcement de bord (150) est
50 orienté dans la direction longitudinale.
32. Article absorbant (20) selon la revendication 26, comprenant une pluralité d'éléments de renforcement de bord (150).
- 55 33. Article absorbant (20) selon la revendication 32, dans lequel au moins certains des éléments de ladite pluralité d'éléments de renforcement de bord (150) sont disposés de façon à former une lettre "E".
34. Article absorbant (20) selon la revendication 26, dans lequel ledit élément de renforcement de bord (150) comprend un morceau de mousse.

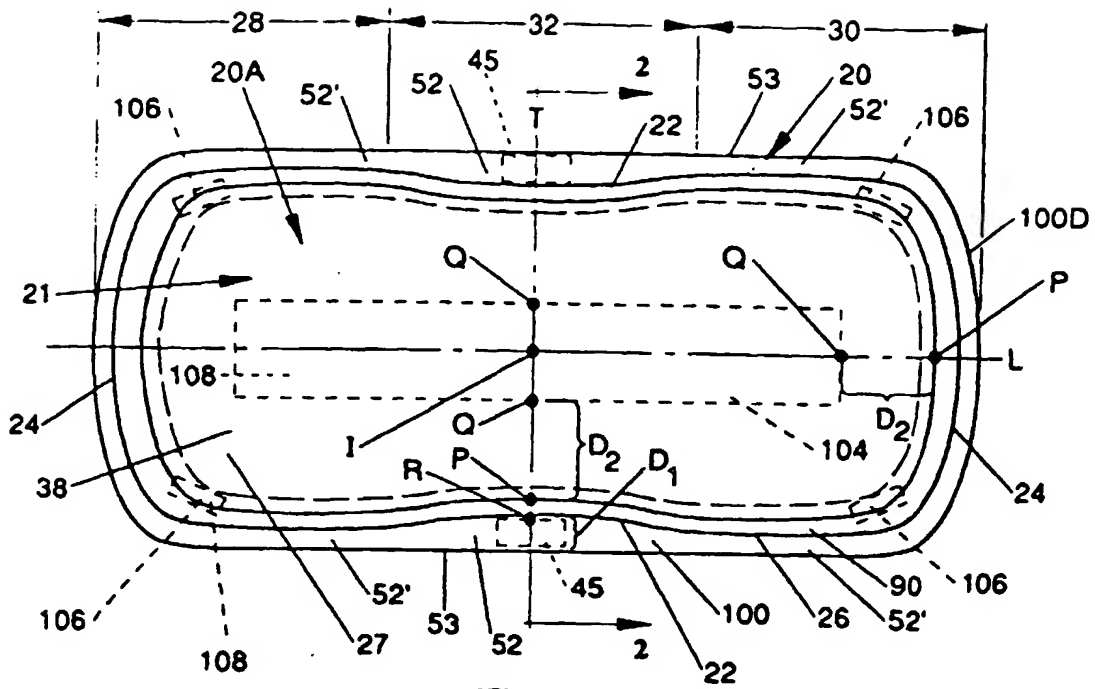


Fig. 1

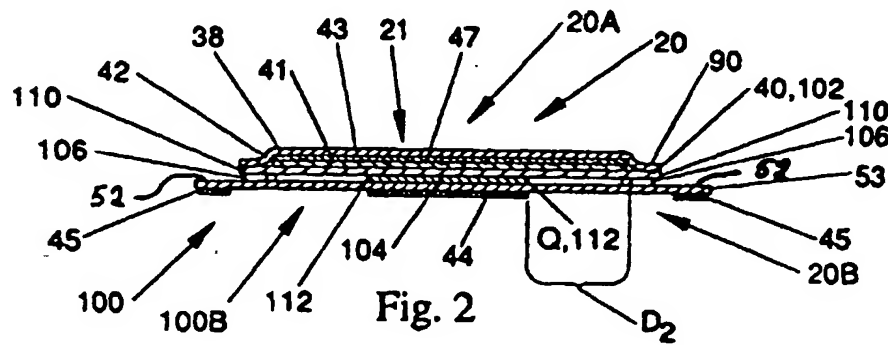


Fig. 2

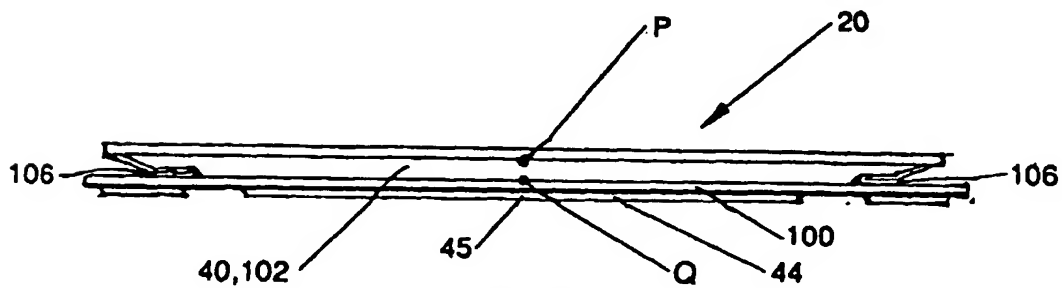


Fig. 3

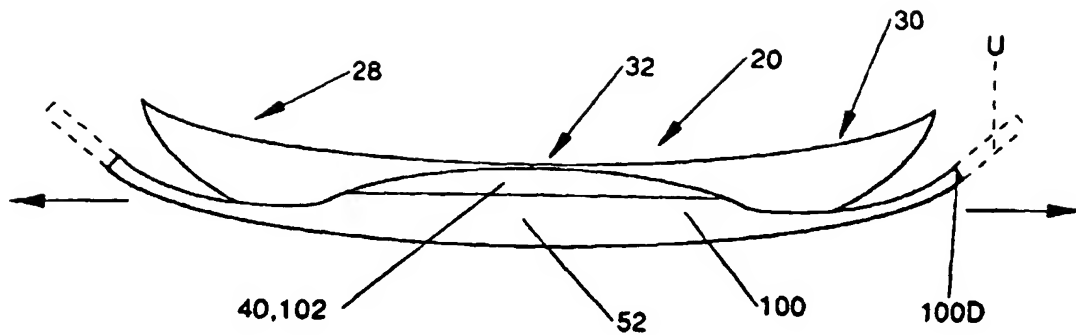


Fig. 4

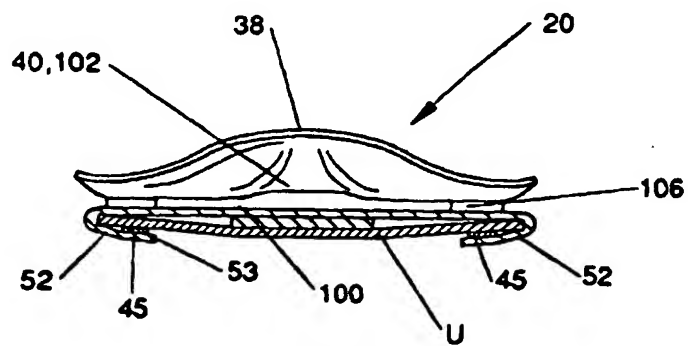


Fig. 5

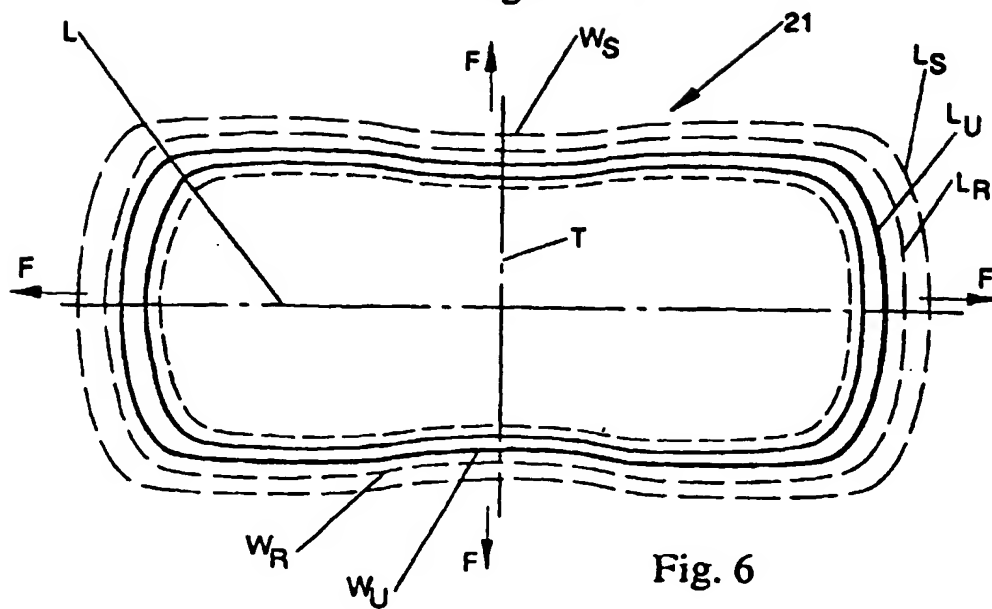


Fig. 6

LONGITUDINAL				WIDTH			FORCE WALL	
CONDITIONS FOR STRETCH	% LONGITUDINAL STRETCH	g. OF FORCE TO EXTEND PAD	% PAD SET	% WIDTH STRETCH	g. OF FORCE TO EXTEND 1.0" STRIP	% PAD SET	% STRETCH	g. FORCE
	40%	≤1000 g. ≤800 g.	≤10 ≤10 ≤25	40%	≤500 g. ≤400 g.	≤10 ≤25	50%	1500 g. 2000 g. 2500 g.
MINIMUM FORCE TO STRETCH	25%	≤800 g. ≤400 g. ≤300 g.	≤10 ≤25	25%	≤500 g. ≤400 g.	≤10 ≤25	40%	1500 g. 2000 g. 2500 g.
	25%	≥50 g.					25%	1500 g. 2000 g. 2500 g.

Table 1...Typical Values for Stretch Parameters

Fig. 7

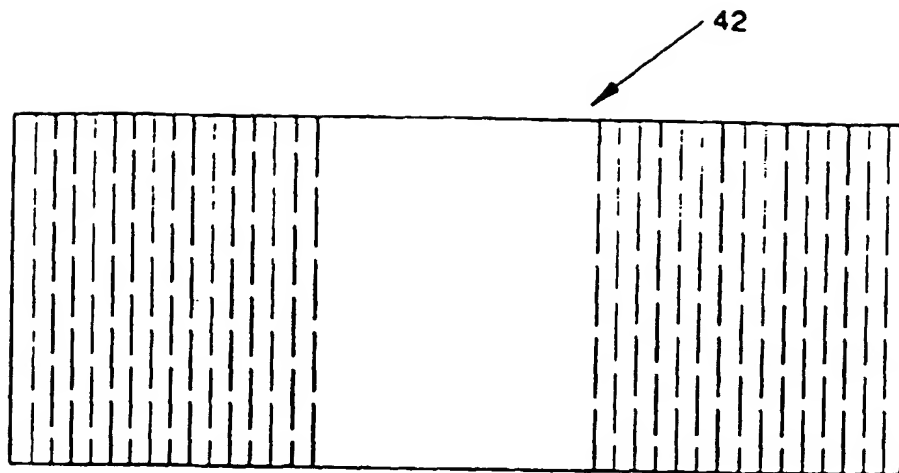


Fig. 8

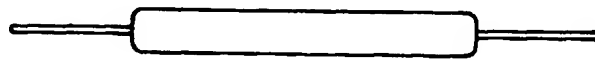


Fig. 9



Fig. 9A

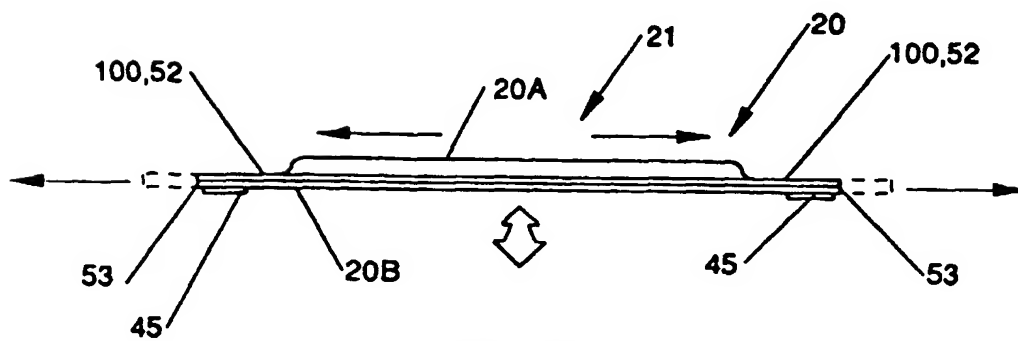


Fig. 10

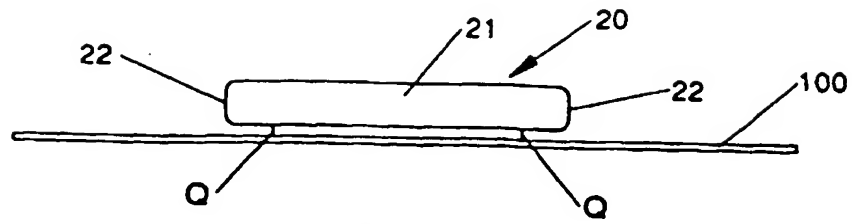


Fig. 11

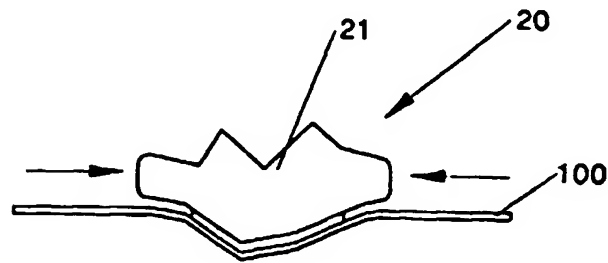


Fig. 11A

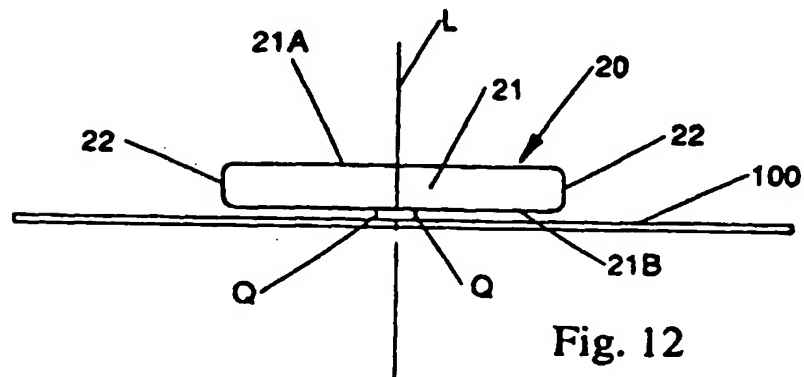


Fig. 12

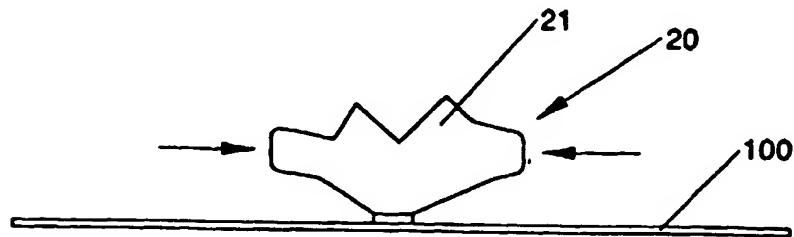
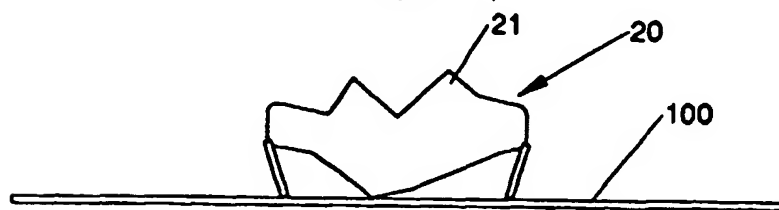
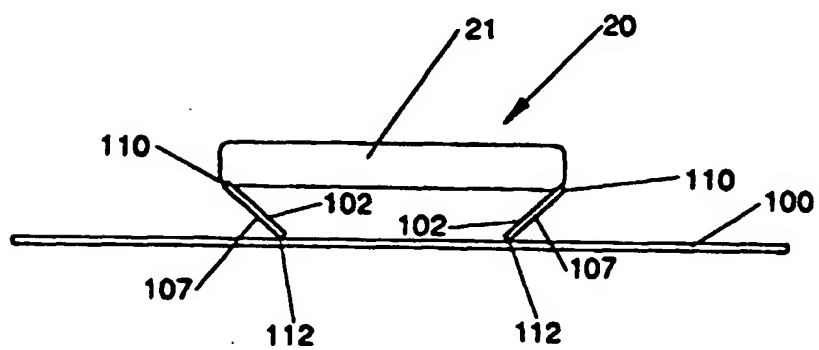
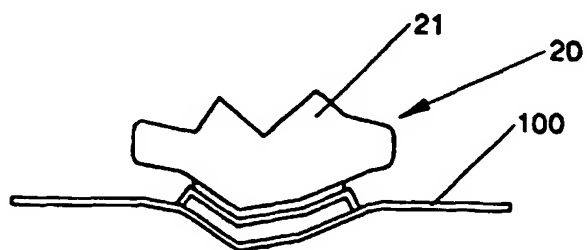
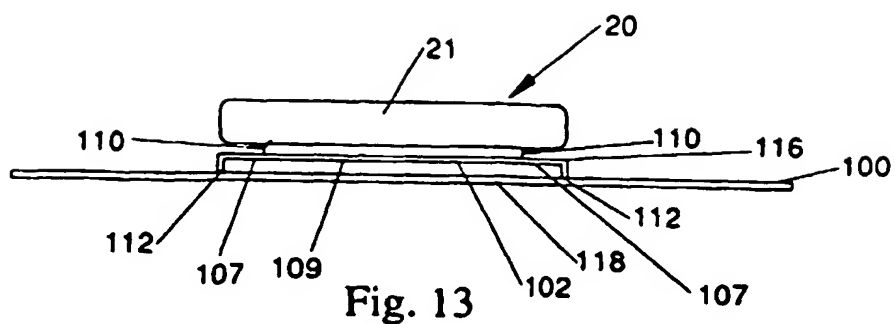


Fig. 12A



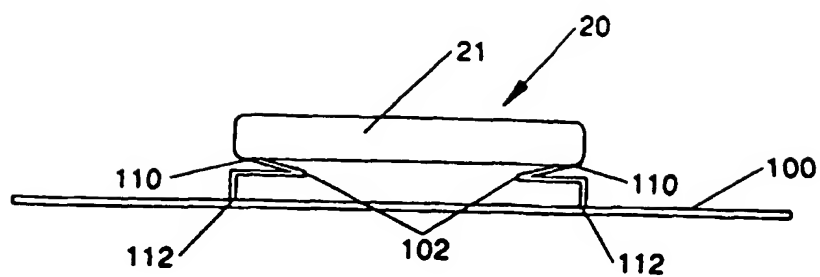


Fig. 15

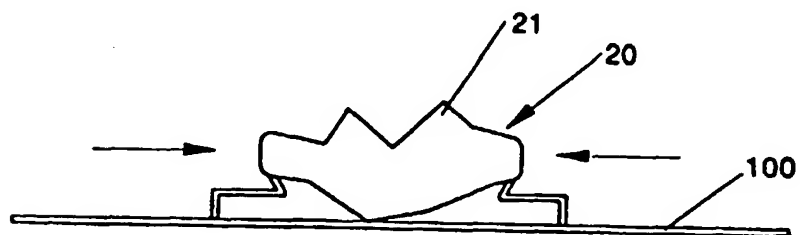


Fig. 15A

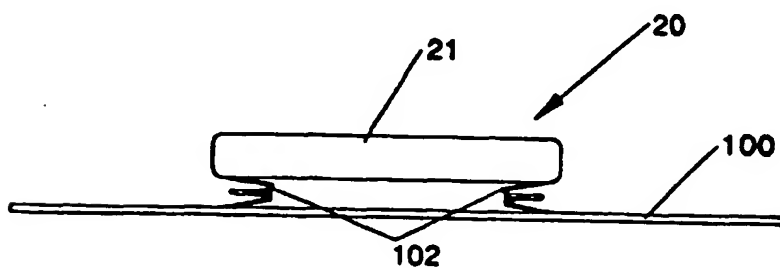


Fig. 15B

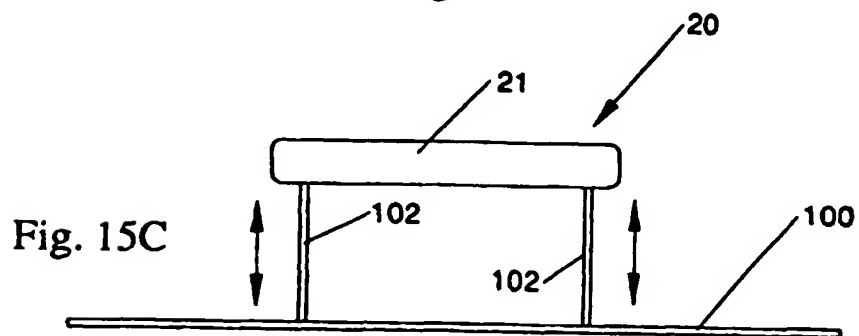
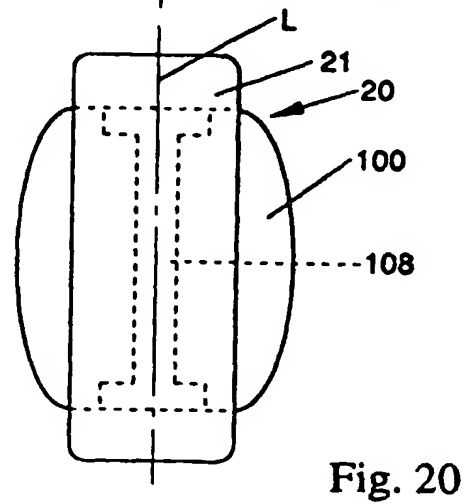
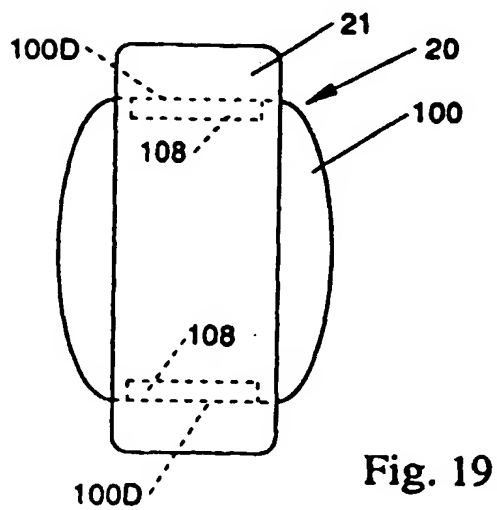
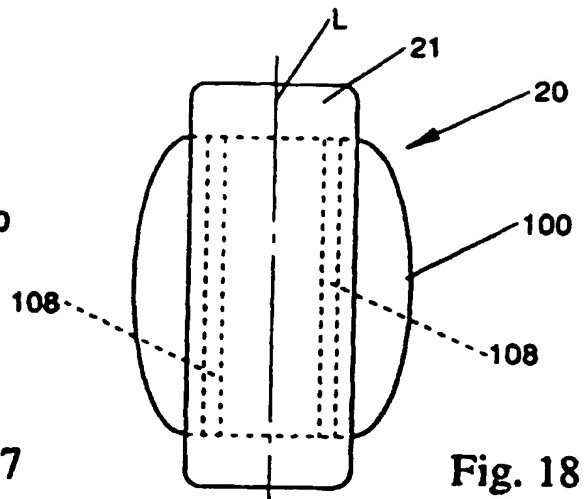
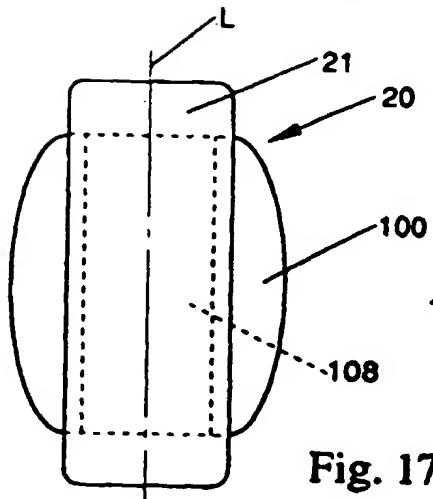
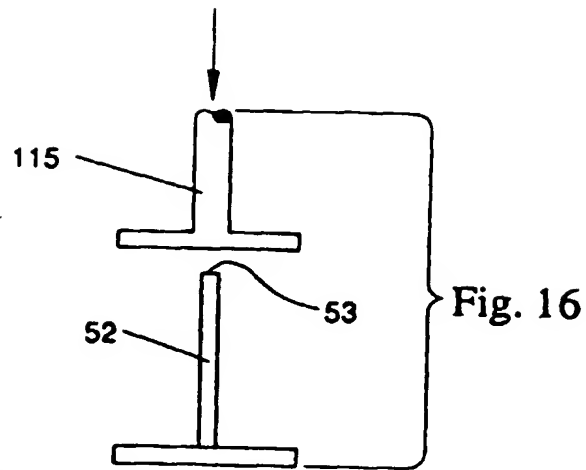


Fig. 15C



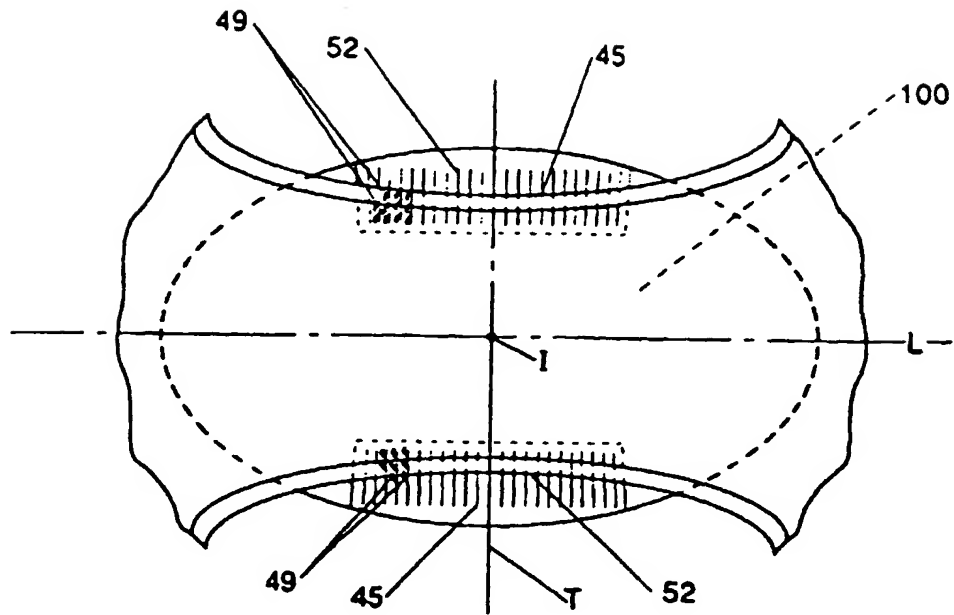


Fig. 21

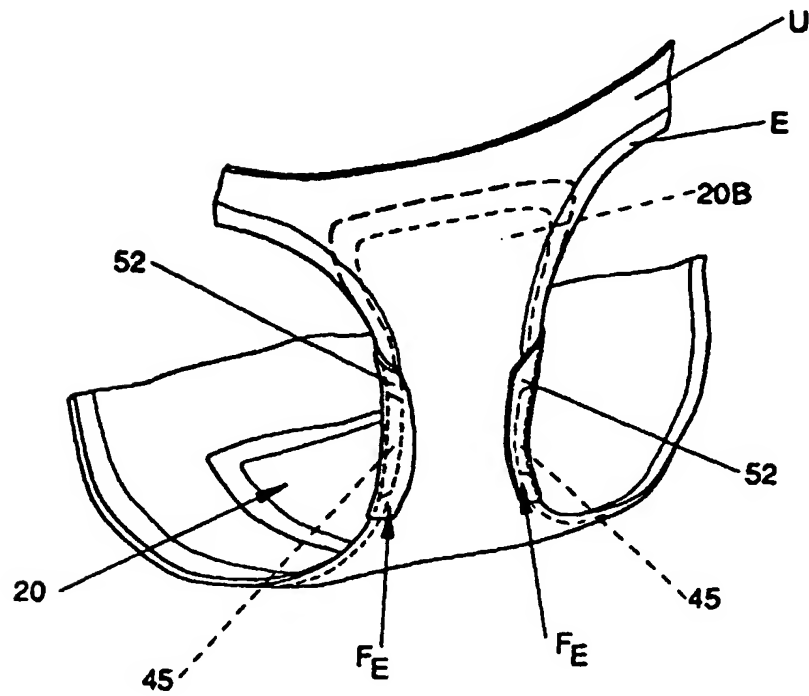


Fig. 22

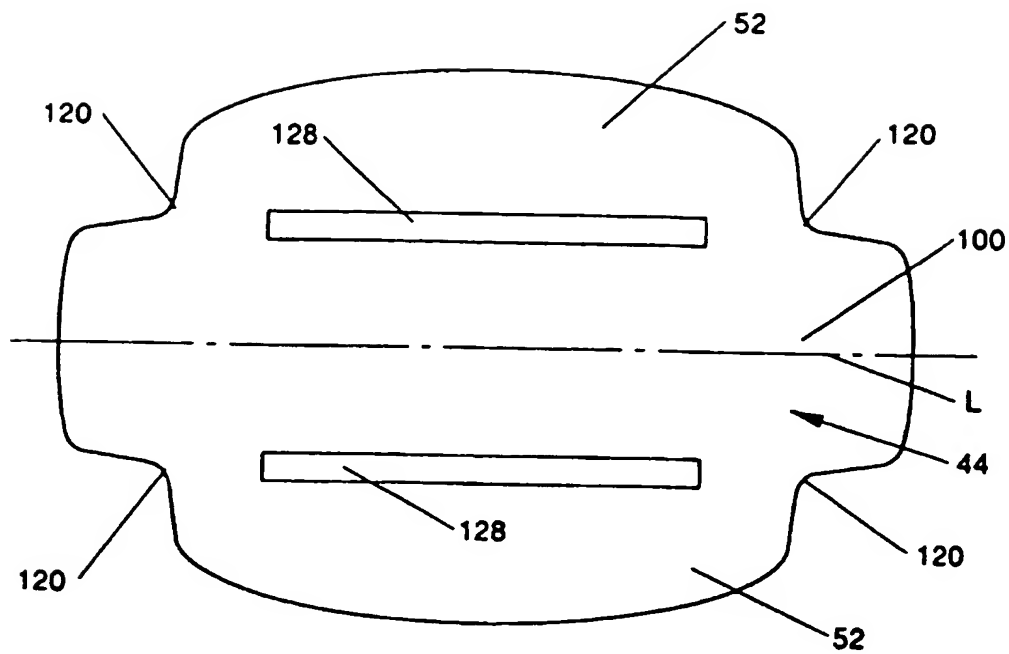


Fig. 23

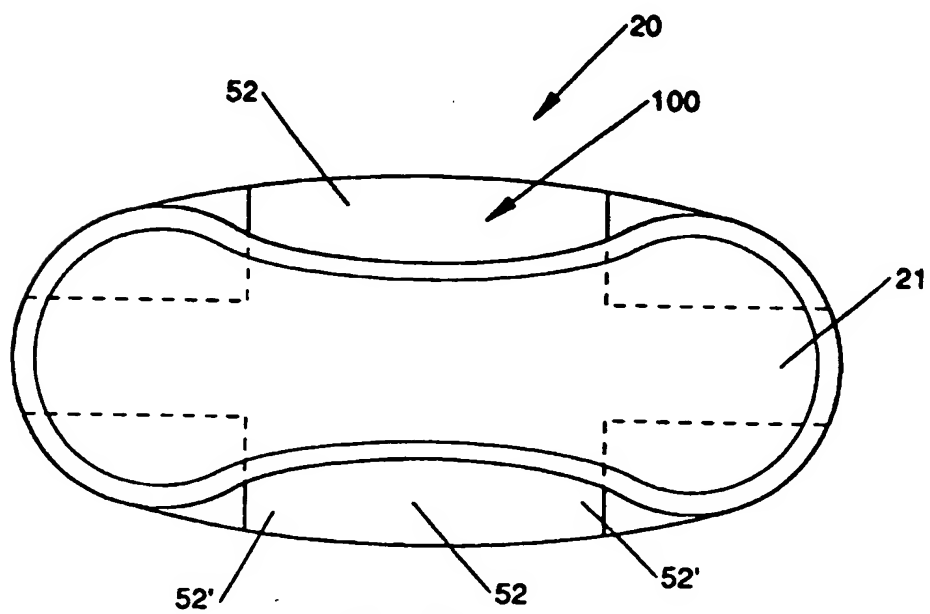
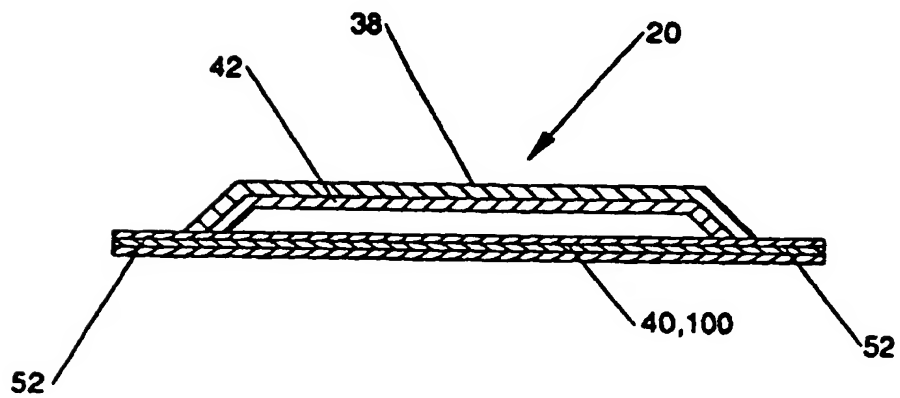
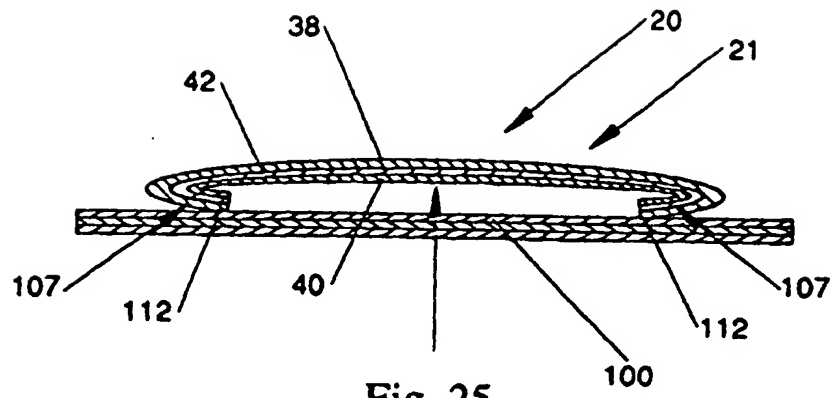
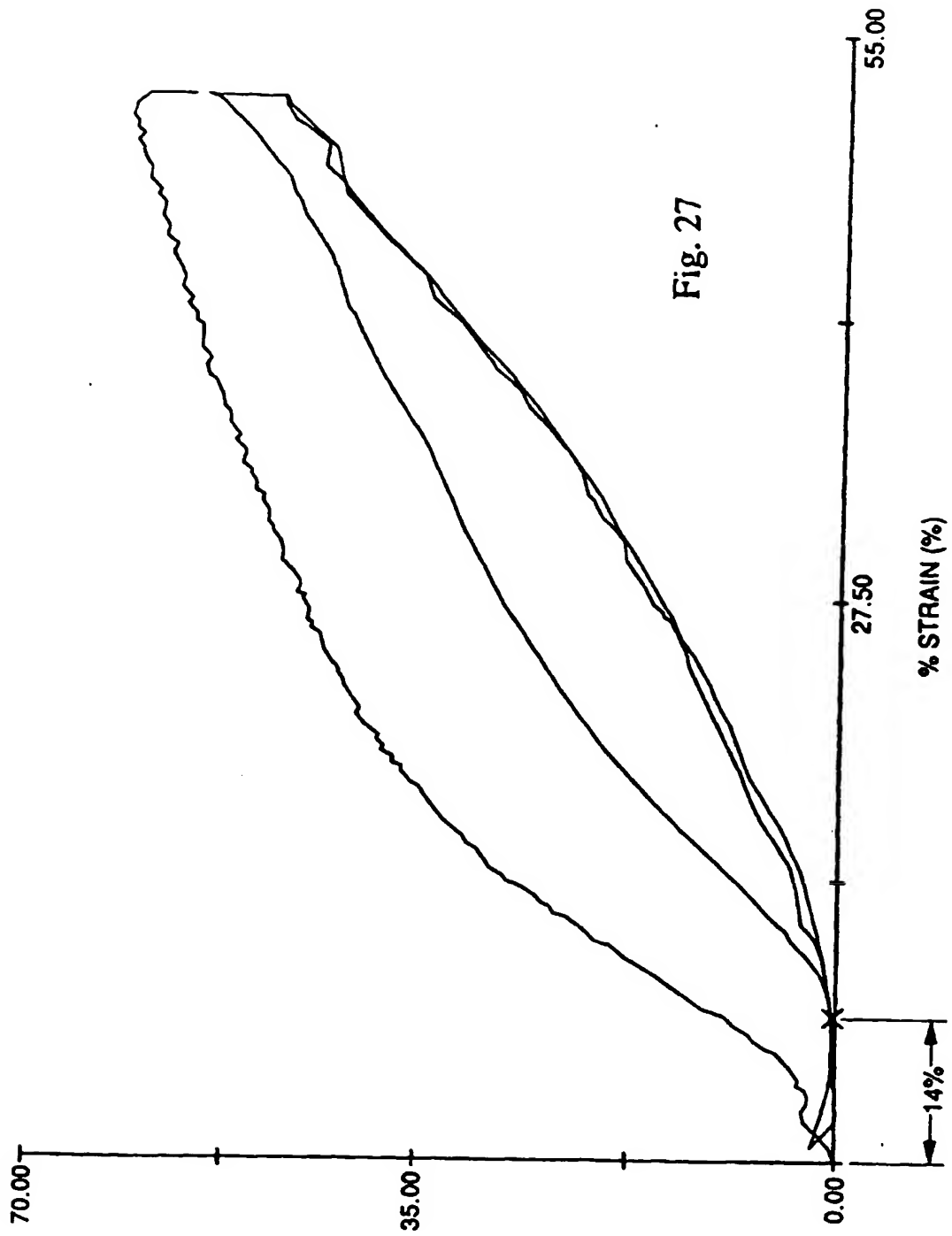


Fig. 24





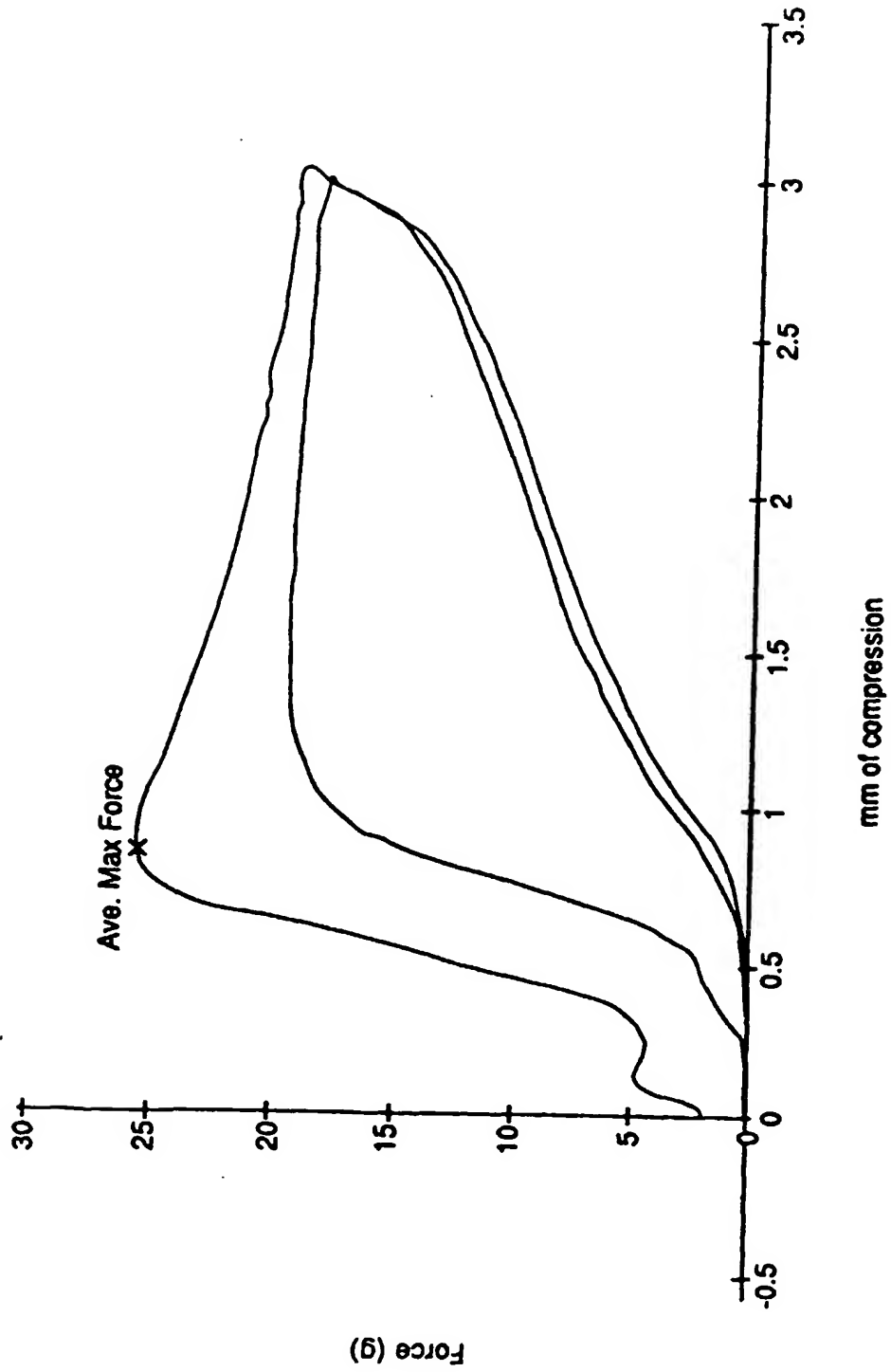
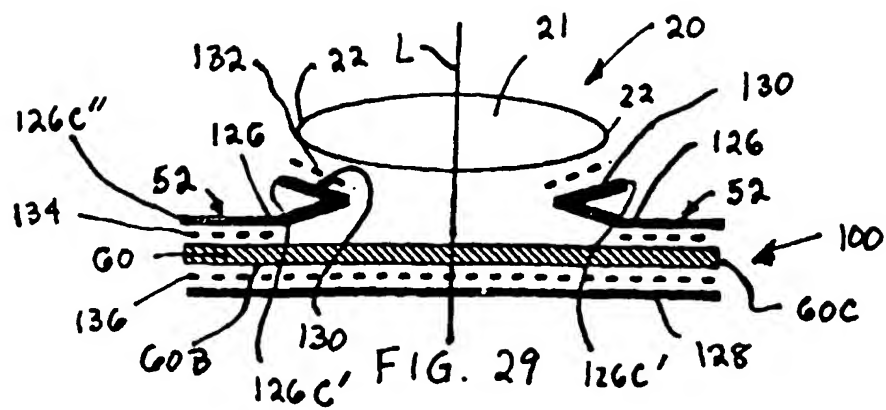


Fig. 28



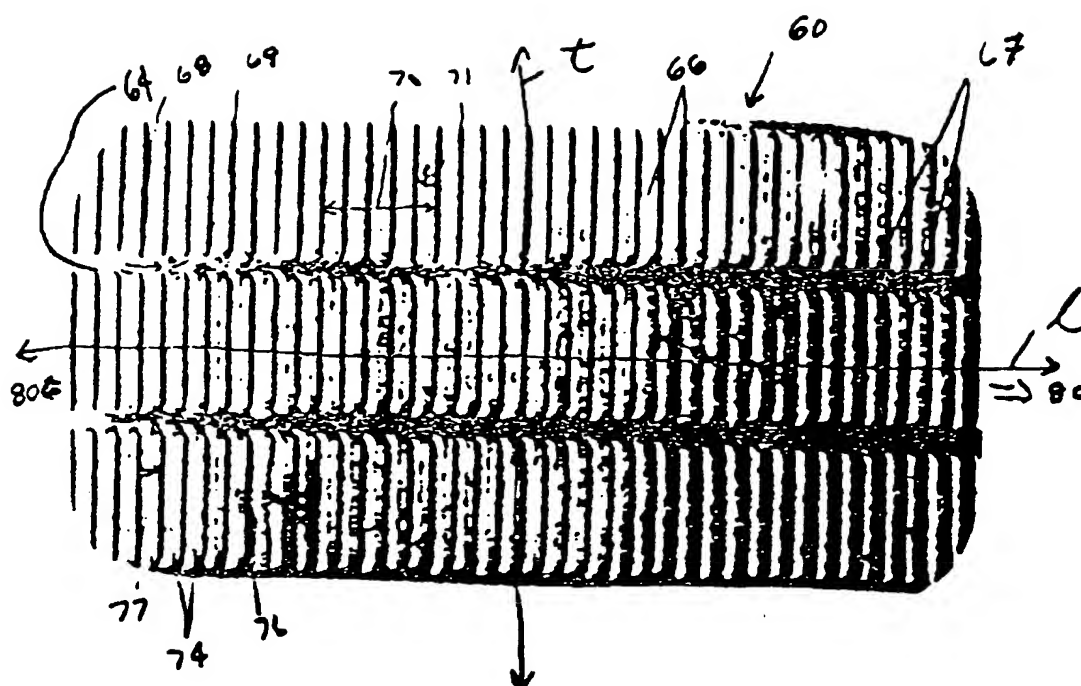


FIG. 30

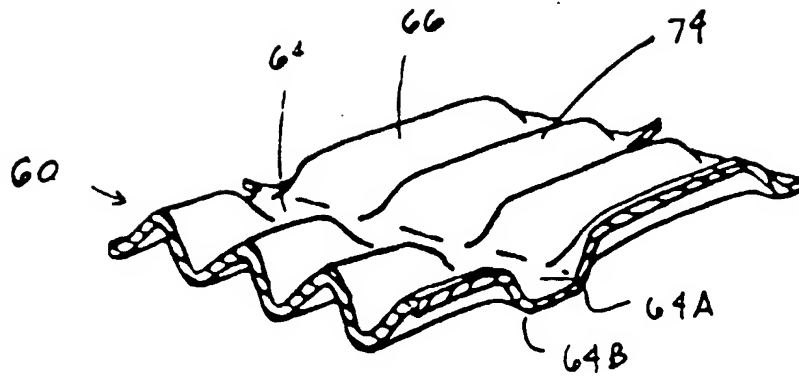


Fig. 31

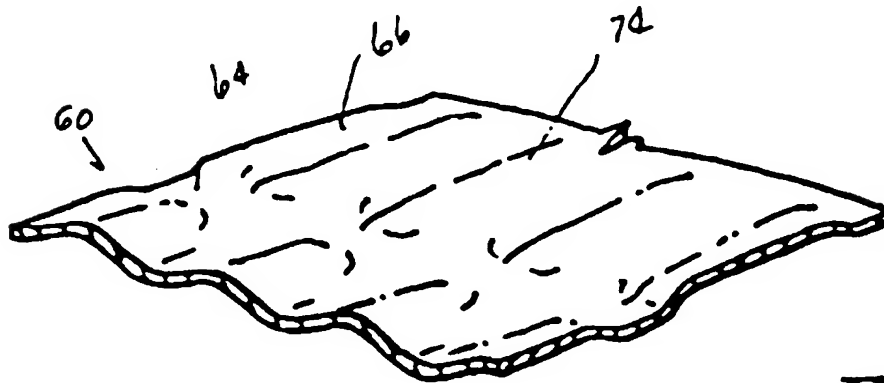


Fig. 32

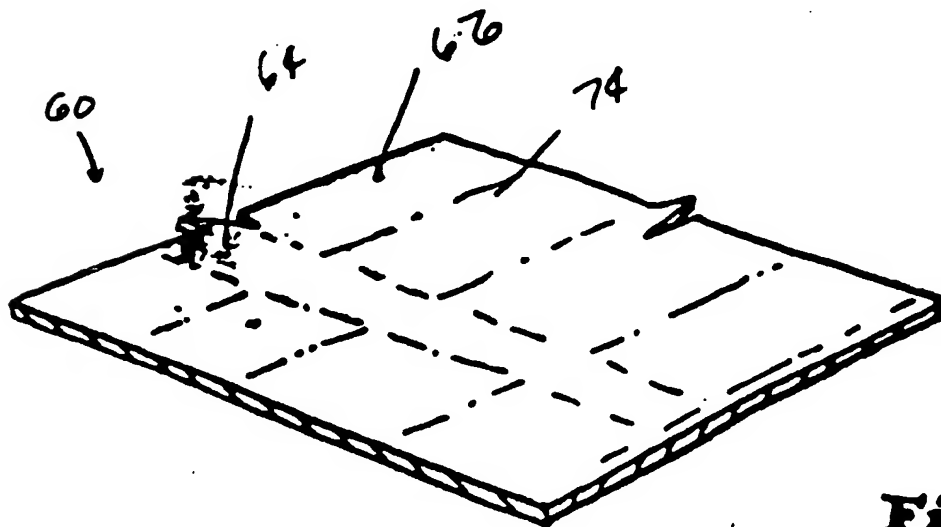


Fig. 33

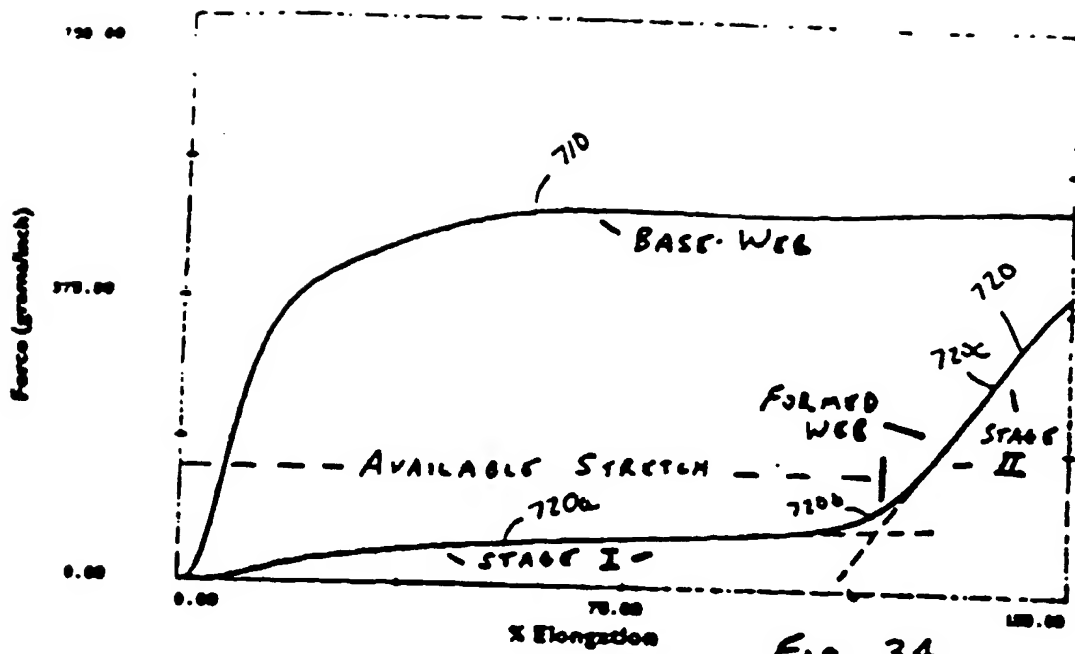


Fig. 34

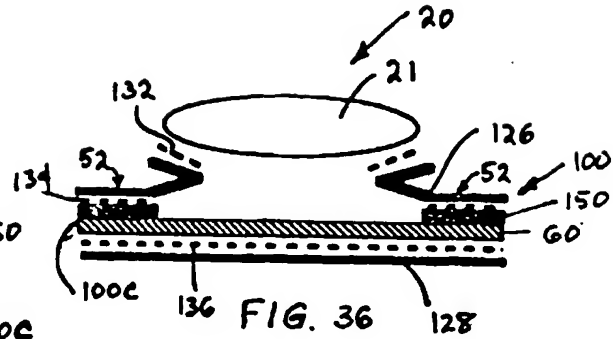
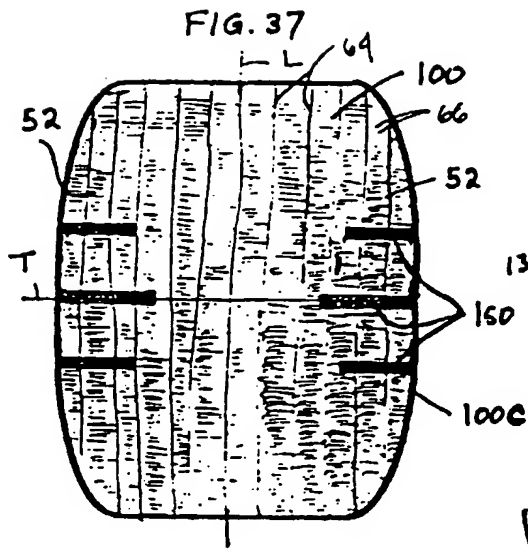
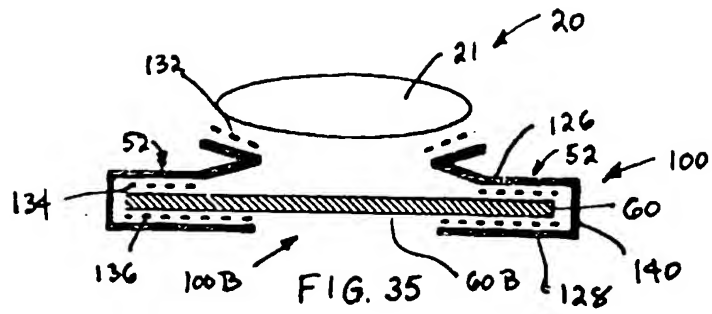


FIG. 38

